GAS JOURNAL

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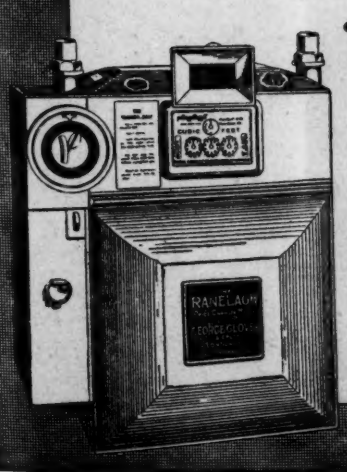

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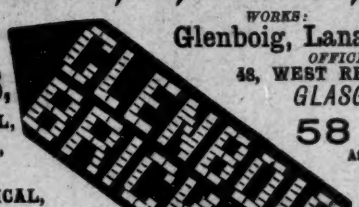

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VOL. CLXVIII., No. 3212.] WEDNESDAY, DECEMBER 3, 1924. [76TH YEAR.

EDITORIAL NOTES.

PROF. SMITHELLS.

THERE is a warm place in the big heart of the gas industry for Prof. Arthur Smithells, C.M.G., F.R.S., D.Sc.; in his heart there is an affectionate regard for the industry and for its men. We of that industry know our friend. We recognize how fully his life has been spent in service—service to science and to industry, and that in his service to industry he has taken a part which has made of his life's work a distinguished success. In the gas industry, for instance, he has not only helped to implant and foster science to our permanent benefit, but he has assisted men to acquire those things which enable them to bring a higher efficiency to bear upon their own activities and upon the operations of the industry itself. And may we not also say that, apart from the highly cultured mind, the innate attributes of our friend have been an example to those whose lives he has helped to mould. Through those lives, he has had part in passing into industrial work, not only science, but something else of inestimable value—a high standard of character.

When a man ceases such work as Prof. Smithells has carried on at Leeds University, and beyond there into the activities of the outside world, and when his work, his counsel, his friendship, have made for him a host of friends—near, and scattered to the uttermost parts of the earth—it is only natural that they should wish in some way to commemorate what he has done and what he has been to them, notwithstanding that the records of science must ever memorialize such constructive work, and that while men live who have come within the personal influence in any way, the teacher and the example will have an abiding place in their memories. They have had their way; and the gas industry has had the pleasure of sharing in rendering honour where honour is so much due. But as in the past, so in this regard; the commemoration of work had, by the desire of Prof. Smithells, to benefit the University for which he had already done so much, and some of the men who will there imbibe fresh knowledge. Thus it is that on Tuesday of last week the late distinguished occupant of the Chair of Chemistry at the University was presented with his portrait in oils, and the remainder of the contributed funds has been devoted to the founding of the Smithells Scholarship of the value of about £100 a year. Into the keeping of the University, the recipient has handed these gifts. The portrait is a welcome addition to those of other distinguished men who have helped to raise the Leeds University to the level of high reputation as a seat of learning which it enjoys.

Fellow workers, old and present students, and many friends were there to witness the crowning event; the gas industry being represented by the President of the Institution of Gas Engineers (Mr. J. Ferguson Bell). The eloquent tributes paid to Prof. Smithells by Mr. A. G. Lupton, Pro-Chancellor of the University, Prof. Cobb, Prof. Connal, Mr. Ferguson Bell, and Dr. Baillie (Vice-Chancellor) portrayed the living high appreciation from many points of view, and in different ways. There was nothing extravagant in the speeches, for the statements were true, and the words genuine. They are fully reported in this issue. The President of the Institution acknowledged the gratitude of the gas industry to its intimate friend for what he has done for it; and Prof. Smithells spoke of his association with the industry, and the happiness he had derived from it. It will be noted with supreme satisfaction that he "rejoices very much that it is still possible for him to go on helping the industry a little on the path on which it is progressing so well, and with ever-increasing advantage." On the part of the industry there will be earnest hope that the valued association will be close and long.

Carbonizing Temperatures.

THE important point was raised at the meeting of the Southern Association of Gas Engineers and Managers last Tuesday, as to whether carbonizing temperatures are not being carried to an excessive height. The question, however, was largely confined to the quantitative and qualitative values of products per ton of coal carbonized, and the effects upon throughput and wages per therm. It was quite easy for Mr. W. H. Warren, of the Gas Light and Coke Company, to show that per ton of Durham coal, and with machine-stoked horizontal retorts, temperatures in the combustion chambers of about 1200° C. are superior to temperatures of 1400° C. We should, before proceeding, congratulate Mr. Warren for his exposition of how to get into a paper of small compass a remarkable number of good debatable points on such a highly important matter. Preliminary to emphasizing the points made, it may be remarked that there are two aspects of the subject which were not sufficiently stressed and brought into the comparison. These refer to capital charges. If by the use of combustion temperatures round about 1200° C. (to use figures given by Mr. J. S. Thorman in the discussion), there is a reduction of 50 tons in the throughput in one retort-house normally at higher temperatures carbonizing 220 tons, to compensate for that would mean the provision of extra carbonizing capacity to meet the requirements of times of maximum output; but *per contra* the higher temperatures insist upon the employment of suitable refractory and other structural materials and better provision against increased radiation and other heat losses, which cost extra money initially and in respect of wear and tear. In view of this, it might be an excellent procedure to adopt Mr. J. Wesley Whimster's proposal to use the lower combustion temperatures in summer and the higher ones only in winter; seeing that in summer there is carbonizing plant to spare. This in turn would make some difference to the characteristics of the gas as between summer and winter. It seems to us that the question of the relative effects of the lower combustion chamber temperatures as compared with the higher ones requires consideration and discussion beyond the limits set by Mr. Warren's paper.

Within those limits, a good case is made out for the lower combustion temperatures—that is to say, having regard only to the values of the yields. Yet in some degree the composition of the coal may have an effect—perhaps not much—upon the case as presented for carbonizing at the lower combustion temperature of 1200° C. This point as to the chemical and physical characteristics of the coal being a factor which should have consideration before accepting Mr. Warren's and Mr. Thorman's figures as universally applicable, was made by Mr. Lawrie Trewby, and was commented upon by Dr. Lessing. In view of this, it appears to be desirable, before coming to any too definite conclusion, that experimental research on similar temperature lines should be made at other works using, in horizontal retorts, classes of coal other than Durham. So far as the case goes in the paper, and there was considerable confirmation in the discussion, production alone favours the lower temperatures with Durham coal. A tabular statement supplies results from four carbonizing plants—three of which are either new

or modernized, while one is as it was some twenty years ago. This one, despite its age, working at a combustion temperature of 1220° C., gives better production results than the others operating at 1380° C. and 1340° C. The therm production at 1220° is 70·31 per ton, against 70·15 with 1380°; coke, 11·41 cwt., against 10·47 cwt.; breeze, 1·58 cwt., against 1·88 cwt.; tar, 10·9 gallons, against 8·2 gallons; 10-oz. liquor per ton, 26·6 gallons, against 27·5 gallons; and the net coal cost (*plus* wages) per therm 1·147d., against 1·495d. But the throughput per day per c.ft. of retort is 53 lbs., compared with 60 lbs.; and the wages per therm, 0·516d., compared with 0·409d. Another striking figure is that the free carbon in the tar with the combustion temperature of 1220° C. is 13·4 p.ct., and at 1380° C. 19·6 p.ct. It is seen from these figures that with the lower temperature a somewhat higher therm make is obtained; there is more coke for sale (less fuel being expended in the process); there is more tar for sale of better quality; and the net coal cost (despite the somewhat higher wages per therm) is lower per therm. Under the conditions named, nothing would be gained by the higher combustion temperatures other than increased throughput and a lower charge for wages per therm; but, on the other hand, the thermal losses would be considerable and the waste of coke a material one. There can be little question that Mr. Warren is right in ascribing the slightly higher gas therm result with the lower temperature carbonization to the reduced degradation of the gas; and this is borne out by Mr. Thorman's experience, which shows a higher methane content—36 p.ct. at the lower temperature, contrasted with 31 p.ct. at the higher temperature—with calorific values for the gas respectively averaging 594 B.Th.U. and 554 B.Th.U.

In the present condition of the coal and secondary products markets, Mr. Warren submits that high temperatures do not pay. That submission, however, may be to some extent discounted, having regard to maximum demand in the winter, when throughput is important, and taking into consideration capital expenditure in dealing with the larger quantity of coal at the lower combustion temperatures. We should like to see discussed, as a supplement to the paper, the question as to the bearing of the higher and the lower combustion temperatures upon capital charges. It seems to us to be rather important, and as intricate as it is big.

Gas-Engines on Hire.

IN some parts of the gas industry it has been taken too much for granted that the town-gas engine load for powers up to (say) 60 B.H.P. is doomed. It is, however, questionable whether the problem has been sufficiently explored to ascertain whether or not there is real justification of this view, and whether there are not ways and means of saving what is admittedly a very desirable business. We do not think it has been; and the gas industry is invited from the junior ranks to consider whether something effective cannot be done not only to prevent further encroachments on this load, but to develop it. The matter was raised by Mr. Harry Clark, of Derby, in his Presidential Address to the Midland Junior Gas Association on Oct. 31 [*ante*, p. 351]; and the subject was considered to be of such importance to the industry that a special meeting of the Association has been held to consider it further. We are glad that this was done; because the occasion was, as the report in other columns shows [p. 657], prolific of argument and illuminating comparative figures—some from power experts with considerable opportunities for obtaining exact information as to the position of the rivals in competition. Three lines were taken in the discussion—the question of cost; hiring; and service in respect of maintenance, repair, inspection, and adjustment.

It is, in the first place, doubtful whether some gas undertakings have fully considered the question as to what they can afford to do in order to retain the power load. Consideration of the matter should be approached from the standpoint that the retention of the power load is of no mean importance, and therefore justifies exceptional measures. In cases where there is a fairly constant eight-hour load, for 44 hours a week and fifty weeks in the year, the business is worth having if a charge can be made for gas showing a profit on holder cost. In such working circumstances, Mr. Clark points out, a 20 B.H.P. engine would consume nearly 1 million c.ft. of gas per annum. That custom through one service, meter, and account is equal to several consumers using gas for domestic purposes, to supply whom the capital and distribution costs would be substantially in excess of those for the one power consumer. Mr. Clark is of opinion that those who have not investigated the point would be surprised at the difference—a difference which alone would justify exceptional terms to the power user. His calculation is that to obtain through domestic custom increased consumption of gas in a new district equivalent to that of a 20 B.H.P. engine, the approximate total capital cost for new mains, services, meters, cookers, supply pipes, &c., would be £766, *plus* depreciation and maintenance, to say nothing of clerical, inspection, and collection charges. In this there is the nucleus of a case for consideration with a view to offering special terms to the regular power consumer—terms showing a profit upon cost into the holder. Better that than irretrievably lose such custom, in view of the fact that it is hoped the ordinary prices for gas will further recede, and that it would be unfair to the power consumer to take the average of costs beyond the holder as applying to his circumstances. In the remarks by Mr. J. W. Walthow and Mr. W. E. Stevenson, data are given as to the costs of gas for power purposes in comparison with electricity, producer gas, and oil. Suction gas and oil fed engines are cheaper; but they have drawbacks (referred to in the speeches) as to attention, reliability, space, and so forth. The modern town-gas engine is altogether a different proposition from the older types—so much so that instances are given where (after experience) the town-gas engine has displaced the cheaper (in respect of fuel) oil engine, which cheapness is largely discounted by large initial and maintenance expenditure, and claims for attention, oil storage, &c. The electric motor from the point of view of cost for continuous running at fairly constant load can be easily beaten by the town-gas engine, though there are some purposes for which the former is more applicable—purposes of intermittent character and where there is propelling to be done. It occupies less space, too, than the gas-engine, though new invention has divested the latter of several objections that obtained when electric motors came on the scene. These objections still exist in some of the old and uneconomical power servants to be found in many factories, experience with which is often the pathway along which the electric motor passes to substitution. But those gas progressives who are out to fight for the power load are showing manufacturers that judgment should be based on the modern engine and not on antiquities. In those cases, electric motors are being displaced by gas-engines. Mr. Clark instances a consumer who, by discarding an electric motor and installing a town-gas engine has reduced his power bill by 50 p.ct. This shows that the subject should be thoroughly investigated by all gas undertakings. But the domestic rates for gas will not do for the power business, though there are some managers who ask why preferential terms should be given to power users—seeing that a therm is a therm to all consumers. Expediency in competition and conditions of supply cannot be ignored. The cost of supplying 5000 therms in a year to one daytime consumer is less than supplying the same number of therms to fifty domestic consumers drawing upon the mains intermittently.

The electric motor has one great advantage. It can be obtained on hire from the suppliers of electricity. That is a condition with which the gas industry has to compete. Mr. Clark and others are of opinion that it would be judicious for all gas undertakings to enter into the competition on the hire basis with engines up to 60 B.H.P.; but, in view of foundation and other installation expenses, there would have to be agreement for the hire of the engine to be continued a sufficient number of years. Consideration is invited to the relation of the capital invested and costs incurred in domestic appliances let on hire which would aggregate an equal consumption to one constant power user. Indeed, hiring, with a suitable price for gas, appears to be the only solution for meeting the electrical power competition; and it will be seen from the Midland Junior discussion that at any rate the two principal makers of gas-engines are willing to assist gas undertakings by offering special terms for engines let on hire. We believe they are prepared to supply engines for hiring purposes by gas undertakings on extended terms of credit, and are considering whether they can further financially assist. Their willingness to co-operate is, it seems to us, a sure sign that there is good business to be done. The matter is worth thorough investigation, without which a *non possumus* attitude is simply ridiculous, in view of the amount of business at stake. There is one large gas undertaking which would have to confess to a loss of half

their power custom in the last fifteen years solely due to the fact that their old power customers have been able to hire electric motors instead of facing the capital expenditure to replace gas-engines thirty or more years old. They cannot be expected to do this when electric motors are available on hire terms. In the same case, too—and this is fairly general—the electricity undertaking has large workshops and stores for dealing with hired motors, and in the event of a mishap the motor is speedily changed from stock. The same provision will have to be made by gas undertakings intending seriously to tackle the power load. In the large and medium-size concerns a department should be established on a scale sufficient to undertake all kinds of repairs, and supply and fix or change gas-engines, as well as capable of doing all installation work, including concrete foundations, extending shafting, fixing pulley wheels, &c.—in fact, in this business the gas undertaking should be the sole contractor.

The subject of hiring-out engines is a particularly important and interesting one; and we should be pleased to have all points bearing upon it discussed in our columns.

Sulphate of Ammonia Policy and Outlook.

THE report of the Council and the Executive Committee of the British Sulphate of Ammonia Federation, Ltd., with the address of the Chairman (Mr. D. Milne Watson) at the annual meeting, as published in the "JOURNAL" last week, are peculiarly interesting, as they show how surely the commercial position of sulphate of ammonia is developing according to the anticipations of those who have made close observation of the trend of events during the past few years. There is indication that the facility of production is now much greater than that of the development of consumption. At the same time, the latter is promising to those who are able to scrutinize the growing needs of the world, though these are not expressing themselves at a sufficient rate to enable the Chairman to make any prediction as to a material increase in price from present market values, as he would assuredly have done had the conditions authorized him to do so. But there is no pessimism in the report or in the speech—in fact, in view of the position of production, the increasing absorption is a matter for hopefulness and even encouragement. Complete justification, however, is found for the policy which has been pursued by the Federation, and which is confirmed by the similar policy of important groups of producers on the Continent—that is, the reduction of price in order to foster consumption. Those who have been critics of that policy must, we think, now see the wisdom of it. During the year under review, there was an increase of nearly 8 p.ct. in the world's production of sulphate of ammonia—making the total output about 2,473,000 tons—thus, as the report puts it, securing for sulphate of ammonia the premier position among nitrogenous fertilizers, so long held by nitrate of soda. We do not know that a premier position based on the quantitative output is anything about which to boast much, except that the fact of absorption attests popularity, but the popularity has been largely obtained through the policy of giving better value for money than can be secured elsewhere in the fertilizer markets. The position is that if the price for the year under review is compared with the average prices for the years 1921-22 and 1922-23, it is seen that the 8 p.ct. increase in consumption has been realized at the cost of a reduction of 10 p.ct. in price. But the situation is insistent as to the prudence of sacrificing something in the way of immediate profits for the sake of future extension of the business, and of spending large sums on propaganda. This policy has been already vindicated. Indeed, we have not the slightest doubt that had it not been pursued—aided by diplomatic action, supported by the hearty co-operation of 90 p.ct. of the total production of Great Britain (including Synthetic Ammonia & Nitrates, Ltd., who are the largest makers in the country)—the market for sulphate of ammonia would by this time have gone largely to pieces, or would have been in proximity to that condition.

A few points as to the future. In the first place, it must not be overlooked that German synthetic sulphate is now on the export market in large quantities. On the other hand, the nitrate of soda people have had to reduce their production to maintain their prices. The growing competition for the export trade necessitates that the British Federation must keep closely in touch with the overseas markets, existing and potential. Their "intelligence department" must be continued in a high state of efficiency; and if consumption is to be increased sufficiently rapidly to absorb the fresh supplies of nitrogen which will be available shortly, propaganda both at home and abroad must be (if anything) intensified. Costs of production, too, must be reduced as far as possible by the application of every economy and close supervision to secure the highest possible efficiency. In this regard the sulphuric acid manufacturers should make further efforts to assist their customers—the sulphate of ammonia producers. Mr. Milne Watson sees room for this being done. To assist development, too, there is the question of producing what is required in respect of quality. Much work has been done by the Federation and others in this direction, with highly beneficial results. An important point to note is that buyers have now a preference for neutral sulphate of ammonia which contains distinct crystals; and these should be as large as the plant can produce. The disadvantage of the powdered form is that it cakes, or is scattered by the wind. The report and the address of the Chairman show conclusively that the coal-carbonizing producers of sulphate of ammonia are making closer and closer contact with the new conditions; and the stronger they can entrench themselves by present judicious action, the better for the future. That is obviously the aim of the policy and the advice of the Federation, the Council and Executive of which, by the way, are not without hope that it will be possible in the future to raise the price of sulphate of ammonia to a level more nearly approaching parity with nitrate of soda than has been possible hitherto. This is encouraging.

Useful Modifications in the Education Scheme.

THE past year's experience of the Education Scheme has shown places here and there where modifications in detail would improve its symmetry, its usefulness, and equity to all classes of students, without affecting the interests of the industry. The means of effecting the necessary changes have been formulated, agreed to by the Advisory Committee, and now await ratification by the Council of the Institution of Gas Engineers. That, in our opinion, will only be a formal matter, as every one of the changes that have been made must commend itself to those who have taken an intimate interest in this vital matter of raising the qualifications of those who are destined to engage in the technical work of the industry—whether manufacture or supply. The modifications are described by Mr. Walter Hole in an article which appears on a later page.

The changes being of a nature that will meet with general approval, there is no necessity to do more than indicate their intentions here—leaving Mr. Hole's article to furnish more minute information. In the first place, many of our most successful gas engineers have commenced their practical training in the works of the manufacturers of gas plant; and, as a rule, such engineers know more regarding the constructional details of the plant and its management than men who have had a purely gas-works training. There are young men in the service of plant manufacturers who would like to enter for the gas engineering examinations. But the original scheme contemplated that the candidates for examination should have an extended gas-works experience, if certification was to be of value. Many of the men engaged at the works of manufacturers, however, have had experience over prolonged periods in the supervision of carbonization plants. This cannot, or should not, be ignored. It has therefore been resolved to admit such candidates to examination, if they can satisfy the Committee as to their experience having been of an extended character, and if the other conditions of examination can be complied with by them. Their success in the examinations will secure for them certification. Men who have merely had experience in the drawing-office or as erectors, and have not been engaged in the actual working of carbonizing plant, are in a different position, but they need not now be disheartened. They will be admitted to examination, and, if successful, they will receive a letter which will have the effect of an interim certificate. Should they subsequently enter the gas-supply industry, and obtain a sufficiently extended practical experience, the Committee will then exchange for the letter one of the regular certificates. A new arrangement is also proposed—to extend the hours of sitting for the examination from four to six, with an interval midway. Experience dictates the expediency of this change.

The most important matter of all has been to deal with

two difficulties which have arisen in connection with the examination for the Diploma. Aspirants for this honour found before them the heavy bar of the Higher Certificates in both Gas Engineering and Supply. It has been seen how this stipulation would operate against many desirable would-be candidates from the larger undertakings—some of whom have a considerable experience within the works, and little in the matter of gas supply, while in the case of others the reverse is the position. The difficulty for such candidates for the Diploma is plain; but a way-out has been found. It is now intended to provide that the candidates for the Diploma in Gas Engineering must possess the Higher Certificate in Gas Engineering and the Ordinary Certificate in Supply; and the candidate for the Diploma in Gas Supply must possess the Higher Certificate in Supply and the Ordinary Certificate in Gas Engineering. That again is a politic change; and so is the one which has been arrived at by the Committee, in consultation with Prof. Cobb, and which deals with university students who have gained a degree in Gas Engineering. There are two points in connection with such candidates which have had to be considered. In the first place, it is necessary for the Diploma they should have had works experience; in the second place, it would be unjustifiable to ask a man who had secured a degree in Gas Engineering to sit again for examination. It is now to be provided that a candidate who has taken an approved degree in Gas Engineering in a British university shall not be asked to take a further written examination, but he will be required to present a thesis, or published work of his own, to submit himself to a *viva voce* examination, and to produce evidence of professional experience satisfactory to the Committee. This change will do much to link-up the work at the universities with the Education Scheme. There has also been an easing of the conditions in connection with candidates who may fail in one of the sections of the examinations at a single attempt. It has been decided that any candidate who fails in either the written portion of the examination or his thesis, may in the following year sit for examination in the section in which he failed; and, if then successful, he would not be required to take again the portion of the examination in which he had previously passed, although he would still have to undergo the Oral Examination. These appropriate modifications of the Scheme should have a good effect upon the number of candidates who will be making application on or before the 31st of this month to sit for the Diploma Examination.

The Financial Result of 1923.

THE Board of Trade annual returns relating to the finances of the gas undertakings operating under statutory powers have been issued. They relate to the year 1923 in the case of companies, to that ending March last in the case of local authorities, and to that ending May 15 in the case of undertakings in Scotland. The part of the official record as to manufacture and sales was published, and was dealt with in the "JOURNAL," early in September, and in view of the healthy expansion of business then shown, there will be interest in investigating the financial history and outcome of the year. It might have been anticipated that, owing to the greater sales of gas, the gross profits would have been considerably augmented. But there was a contrary issue. The revenue declined to a greater extent than the fall of expenditure—by £444,758. The receipts for the year, £67,576,358, were (despite the increase in business) less by £3,050,293; and the expenditure, £56,593,900, by £2,605,535. Thus the one did not compensate the other by the sum already mentioned. The aggregrate gross profit was £10,982,458, compared with £11,427,216 in the previous year. The reduction was mainly due to the continued lowering of the price of gas to consumers; and, of course, tar and sulphate of ammonia did not maintain their previous levels. But there has been no occasion to increase the charges. In view of the high prices for gas during the war, the policy of the lowest possible charges to the consumers is a good one; and that it is so is shown by the fact that in the year covered by the returns, the sales of gas reached 241,626,603,000 c.ft., representing on the previous year the gigantic increase of 9,023,814,000 c.ft. The number of consumers also advanced during the year, by 138,204, to 7,810,350. From what we hear, the increase in consumption and new consumers and connected appliances continues in a manner which is highly gratifying, so that the returns for 1924 should make a good showing.

Midland Association.

The Midland Association of Gas Engineers and Managers last Thursday held a meeting which produced considerable technical interest. Two papers were read on vertical retort operation and results—one by Mr. Frederick Shewring, of Stratford-on-Avon, on "Continuous-Intermittent Verticals," and the other by Mr. Charles F. Tooby, of Coventry, on "The Working of Vertical Retorts at the Foleshill Gas-Works." The former is published this week with a report of the discussion; and the latter, with the discussion upon it, will be given next week. An opportunity will then be taken of making editorial reference to the contributions.

Distribution Systems and Legislative Proposals.

This is the season when responsible officers of gas undertakings should examine very carefully the notices of legislative proposals of county councils, local authorities, and railway companies, to see whether or not any of them is likely to affect their interests. There is good ground from past experience for suspicion regarding their activities in seeking new powers or protection which will be detrimental to gas undertakings. The National Gas Council give warning of this in a communication of which particulars are given in a later column. Heed should be paid to its injunctions—particularly the one that any suggested trespass upon rights, or any proposed new agreement, should be notified immediately to the National Gas Council.

The Cannon Street Mint.

After Navenby, the "Electric Light and Power Contracts Finance Corporation, Ltd.," is once more put forward in the same meretricious form for raking in more money. We see in the prospectus that the "Electricity Finance and Distribution Corporation, Ltd.," undertake that, if the notes (forming part of the present issue) are not promptly redeemed by the "Electric Light and Power Contracts Finance Corporation, Ltd.," they will do certain things; and a memo from the "Electricity, Gas, Share Debenture Investment and Guarantee Trust, Ltd.," strongly recommends early application for the new capital. Investors will no doubt be delighted over this solicitous interest in them of the various arms in the mechanism of the promoters with their centre of activity at 43, Cannon Street. The present issue consists of 15,060 "8 p.ct." preference shares of 10s. each (free of income-tax). There are also 21,512 "8 p.ct." participating short-term notes of £1 each, which are repayable on or before March 1, 1930 (as guaranteed), at a premium of £10 p.ct.; or they may be exchanged for debentures—when issued. Then there are 9300 founders' shares at 10s. each. It is asserted that the estimated profits on the business will provide three times over the amount required to pay the fixed dividend and interest on the whole of this substantial amount of capital. No disclosure is made as to the nature of that business. Perhaps some of the money is to be utilized in putting down a diminutive electric plant at the small Navenby Gas-Works. The statement is again trotted out that the "Corporation" have acquired an interest in an important invention, whereby it is estimated that, by generating electrical energy in bulk, the fuel cost of producing electric light and power will not exceed $\frac{1}{10}$d. per KW.-H. or $\frac{1}{12}$d. per H.P.-H. We will not go into the further generalities in this prospectus, nor need we comment on the golden harvest (on paper) which is the bait. The whole thing is too absurd to catch people with unimpaired mental equipment; those who do sink money in such a concern and on such a prospectus ought to be put into safe keeping. The baronet Soame is the Chairman; and other familiar names on the Board are Thompson, Mann, and Buik.

And More Money for Heathfield.

No sooner have we filed away the prospectus referred to in the preceding paragraph, than another reaches us. A big sum of money is required for the Heathfield and Waldron Gas Light and Coke Company. The usual "memo" is issued from 43, Cannon Street by the Trust with the cumbrous name—the "Electricity, Gas, Share Debenture Investment and Guarantee Trust, Ltd."—who naturally "strongly recommend the securities as a promising investment with considerable future prospects." If all the money asked for is provided, there will be little doubt as to the nature of the "considerable future prospects." In the capacity of Directors, we see the names of Calvert, Mann, Buik, and Newman.

We have met with them before. Incidentally it is noticed that a Director need not be personally involved to a greater extent than ten shares, that being the qualification. The money needed is only a matter of £16,481 (!) divided into 2000 10 p.ct. preference shares of £1 each (fully paid, at the price of £1 15s. per share, part of the original capital issued); £5000 first mortgage debentures in multiples of £10 each at £9 10s. per debenture, bearing interest at 5 p.ct. per annum; and 9481 7 p.ct. ordinary shares of £1 each at par. The capital, it appears, is needed for plant and main extensions; and to the technical man it will be interesting to know that "these further extensions, when completed, are estimated to eventually increase [*sic*] the sales of gas by 5 million c.ft., in addition to the output of coke and residuals." There is an ugly disproportion between the 5 million c.ft. and the capital required. Confidence as to the increase of sales is rather spoilt by the word "eventually," which might apply to 1000 years hence. This prospectus is dated Dec. 1. Last July a prospectus was issued for the same Company, offering 3000 10 p.ct. preference shares and 10,000 7 p.ct. ordinary shares. Apparently the applications on that occasion did not satisfy the active spirits at 43, Cannon Street.

Gas-Works Development and Guarantee Corporation, Ltd.

A short time ago we noticed a prospectus of the Gas-Works Development and Guarantee Corporation, Ltd., which informed all whom it might concern that the Western Counties Incorporated Trust were authorized to receive purchases for 1000 10 p.ct. income bonds of £10 each, "being part of a total authorized issue of £25,000, bearing interest at the rate of 10 p.ct. per annum, together with a further participation in the profits." The prospectus has been re-issued with fresh statements designed to attract the public. Repetition is made of the alluring vision: "In addition to the 10 p.ct. interest, bondholders will participate in half the profits of the Company up to a further 15 p.ct., making a total of 25 p.ct. per annum on each £10 income bond." The financial positions of certain well-established concerns are quoted, and the prosperity of the gas industry is glowingly pictured. The Corporation devoutly hopes that it will be the medium of establishing a number of very successful gas light and coke companies; and operations in this direction are to commence in South Oxfordshire. The Directors are A. Morley Everett, Ivor C. Kingdon (described as a gas and electrical engineer), Frederick C. Owlett, and William R. Bryan. When previously noticing this Company, we failed to trace Ivor C. Kingdon in our list of professional gas engineers. The prospectus is all too vague and foundationless to obtain any serious consideration from investors.

Institution of Chemical Engineers.—The next meeting will be held next Wednesday (Dec. 10) at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W. 1, when Mr. A. J. V. Underwood, M.Sc., A.M.I.Chem.E., will read a paper on "The Natural Soda Deposits of East Africa."

Institution of Engineers-in-Charge.—The President-Elect (Mr. T. Cooper, M.A., M.Inst.C.E., M.Inst.Mech.E., M.Inst.E.E.) will deliver his second address to the members, at St. Bride Institute, Bride Lane, E.C., on Wednesday evening next (Dec. 10), at 7.30. He will take for his subject "The Responsibilities and Training of the Engineer-in-Charge."

Coming-of-Age of the Leeds University.—The celebration week to commemorate the jubilee of the Yorkshire College of Science and the coming-of-age of the University is fixed for Dec. 15 to 20 inclusive. The programme is full and interesting; one of the features being the conferring of Honorary Degrees on certain persons who have given distinguished service to the Yorkshire College and the University.

British Engineering Standards Association.—The Main Committee of the British Engineering Standards Association have recently authorized the Secretary (Mr. le Maistre) to accept the cordial invitation of the German Standards Committee (the "N.D.I.") to be present at their annual meeting on Dec. 13. He is also going to Prague to give an address on "Industrial Standardization" before the recently-formed Czecho-Slovakian Standards Committee.

London and Southern District Junior Gas Association.—There is to be a visit of members next Saturday afternoon (Dec. 6) to the Greenwich generating station of the London County Council. At the monthly business meeting on Friday evening, Dec. 19, in the Westminster Technical Institute, there will be two short papers—one on "Maintenance of Apparatus on the District," by Mr. W. R. Moger, of the Tottenham District Light, Heat, and Power Company, and the other on "The Sampling of Gases," by Mr. J. H. Goldsmith, of the South Suburban Gas Company.

PERSONAL.

The Oswaldtwistle District Council have appointed Mr. ARTHUR F. AMES as Gas Manager, in succession to Mr. J. H. Davies, who recently resigned. Mr. Ames was trained under Mr. Davies, and was Gas Manager at Silsden for two years. He is 37 years of age, and a native of Church, near Accrington.

Mr. JOHN LIVINGSTONE, Assistant Manager and Works Superintendent of the Airdrie Gas Department, has been appointed Manager at the gas works of the Tillicoultry Gas Company. Mr. Livingstone, who is a native of Paisley, will take up his new duties on Dec. 8. He has been for eighteen months in the Airdrie works. There was a large number of applicants for the post.

Mr. C. F. BARROW, who has been in the service of the Sunderland Gas Company for twenty-one years, has been promoted to the position of Distribution Superintendent, rendered vacant by the resignation of Mr. J. E. Morfett.

At the Hendon Works of the Sunderland Gas Company last week, a presentation was made from the combined staffs of the Hendon and Ayre's Quay Works to Mr. F. COOKE, A.I.C., Chief Chemist, on his leaving to take up the appointment of Works Manager to the Wombwell Coke and Bye-Products Company. Mr. C. Dru Drury (the Engineer) handed over the gifts, which consisted of two framed water colours, and in a felicitous speech said that nearly seven years ago Mr. Cooke had come to them from the coke-oven industry, to which he was now returning. Mr. Cooke's relations with the various members of the staffs had always been of the happiest; and while they congratulated him on securing his new appointment, they regretted exceedingly his departure. On behalf of the combined staffs he wished Mr. Cooke every success in his new sphere, and trusted that he and Mrs. Cooke would enjoy the best of health. Mr. A. H. Bagshaw (Works Manager, Hendon) and Mr. F. P. Fall (Chief Draughtsman) also spoke in appreciative terms. Mr. Cooke, in responding, said that the seven years he had been with them had been very happy ones. On behalf of his wife and himself he thanked them exceedingly for their splendid gifts and for their kind wishes for the future.

At a meeting of the Lancashire Commercial Section of the Manchester District Institution of Gas Engineers which was attended by representatives of 44 undertakings, reference was made to the impending departure to South Africa of Mr. J. H. DAVIES, of Oswaldtwistle. Mr. Broughton, of Haslingden, proposed, and Mr. Brown, of Leigh, seconded, that the members present extend their very best wishes for Mr. Davies' success. In proposing the resolution, Mr. Broughton spoke of the high esteem in which Mr. Davies was held, and of the keen interest he had always taken in gas matters, also of his valuable assistance as a member of the Committee, and more particularly as a member of many small sub-committees. The resolution was carried with applause, after which Mr. Davies expressed his heartfelt thanks to the members. He assured them that he would never forget the many interesting meetings he had had with them.

At a dinner and informal annual gathering held at Ilfracombe by the employees of the local Gas Company, Mr. R. M. ROWE (the Chairman of the Board of Directors) was presented with a cigar holder on the occasion of his birthday. In making the presentation, Mr. J. Armstrong (Managing-Director) said the gift had been subscribed to by every member of the staff.

OBITUARY.

With keen sorrow we learn, as we are going to press, of the great loss Mr. W. H. BENNETT, Managing Director of the Redhill Gas Company, has sustained by the death of his wife yesterday morning. At the time of the Portsmouth meeting of the Southern Association of Gas Engineers and Managers, Mrs. Bennett was ill, and she subsequently became worse. Sympathetic reference was made to this at the recent meeting of the Association, when Mr. Bennett relinquished the office of Hon. Secretary. Mrs. Bennett was well known to members of the gas fraternity; and near and far the deepest sympathy will be felt with, and tendered to, our friend at Redhill.

The death occurred, unexpectedly, on Nov. 29, after only one week's illness, of Mr. CHARLES D. CAWTHRA, Deputy Gas Engineer to the Halifax Corporation. There was every expectation until the previous day that he would recover, but then he had a seizure, and did not regain consciousness. Mr. Cawthra, who was 51 years of age, was the son of the late Mr. J. S. Cawthra, Deputy Town Clerk of Halifax. After studying at the Halifax Technical School, he entered the gas industry at the Halifax Corporation Gas-Works. He was a well-known Freemason, and a member of the Yorkshire Junior Gas Association for many years past. He leaves a widow and one daughter.

Mr. W. MORGAN LEWIS, J.P., Vice-Chairman of the Cardiff Gas Company, died at Bath on Nov. 25. Mr. Lewis was born in Cardiff in 1855, and began his business career with the firm of William Perch, Ltd., of which Company he eventually became Chairman. He was also Chairman of the New British Rhondda Colliery Company, a Director of the Rigos Colliery Company and

of Messrs. Tellefsen & Co., Ltd., and a member of the Cardiff Coal and Shipping Exchange and of the Monmouthshire and South Wales Coalowners' Association.

Alderman F. C. EDWARDS, who recently died at Harlow, aged 65, was a Director of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company.

With sorrow we learn that Mr. W. H. TILLEY passed away yesterday morning. Partner in business for many years with his brother, Mr. F. C. Tilley (late Chairman of the Society of British Gas Industries), he was well known to many of our readers—particularly in London. From them much sympathy will go to the family in their bereavement, and in this we sincerely unite.

EVENING STAR LODGE, No. 1719.

On Wednesday, Nov. 26, the annual election meeting of the Evening Star Lodge was held at Freemasons' Hall, Great Queen Street, London.

The respective chairs were occupied by W.Bro. Rae P. Normand, W.M.; Bro. Hermann L. Sheppard, S.W.; and Bro. A. H. Henry, J.W. Formal preliminary business having been disposed of, candidates Bros. John A. Williams and Clifford A. King had conferred upon them, by the W.M. and Officers of the Lodge, the degree of a M.M.; W.Bro. W. A. Surridge, P.A.G.D.C., P.M., assisting in the ceremony.

The balloting resulted in the election of Bro. Sheppard, S.W., as W.M. for the year 1925-26, and of W.Bro. E. G. Smithard, P.P.G.Treas., Norfolk, as Treasurer. In recognition of his services to the Lodge as W.M. for 1924-25, it was resolved to present to W. Bro. Normand a P.M. jewel, on his retirement from the chair. The sum of 25 guineas was voted to the Royal Masonic Institution for Boys; but it was decided that, in view of the desirability of concentration of effort on the Masonic Million Memorial Fund, no steward should be appointed for the Boys' Institution Festival this year.

Bro. W. H. Bennett, of Redhill, and W.Bro. Walter Dunn, P.M., L.R., Secretary of the Lodge, proposed and seconded respectively Bro. Edward Henry Swain, of the Merlin Lodge, No. 1578 (Engineer to the Metropolitan Gas Referees), for joining membership; and after various concluding items of business had been transacted, the Lodge was closed.

W.Bro. Normand took the chair at the dinner which followed in the Connaught Rooms. He gave the customary Loyal Toast, and that in honour of the Grand Officers, Past and Present. W.Bro. Surridge and W.Bro. William Belton, P.G.Std.B., responded. The former, in the course of his reply, took occasion to refer with satisfaction to the scheme which had just been announced, whereby the Lodge would take its place with other important London Lodges in the universal masonic endeavour to complete by August next the sum of one million pounds, for which H R.H. the Duke of Connaught had appealed as M.W.G.M. The money is to be expended in the much-needed rebuilding of the Freemasons' Hall, London, as a memorial to the brethren of the Order who made the supreme sacrifice for their King and Country. W.Bro. Frank West, as I.P.M., proposed the toast of "The Worshipful Master," who after responding reciprocated the compliment. Reference was made to arrangements which were on foot for holding a Ladies' Festival in the King Edward VII. rooms of the Hotel Victoria on the evening of Monday, Jan. 26. The toast of "The W.M. Elect" was duly honoured, Bro. Sheppard responding; and that of "Absent Brethren" was proposed at the usual hour by W.Bro. A. E. Broadberry, P.M., L.R. To W.Bro. Alfred C. Beal, P.M., was entrusted the proposal of "The Visiting Brethren." It was acknowledged by Bro. W. Jepson of the Carbon Lodge, No. 2910, Bro. R. J. Meiklejohn, Secretary of the Murdoch Lodge, No. 3480, and Bro. Ronald Glover, of the Northern Star Lodge, No. 3053. The toast of "The Officers and Past Masters of the Lodge" was given by Bro. W. G. Head, and was responded to on behalf of the former by W.Bro. Broadberry, and on behalf of the latter by Bro. A. H. Henry, J.W.

The Golfing Society.

The "Evening Star" Golfing Society, the membership of which comprises brethren of the "Evening Star" Lodge and Chapter, held a very enjoyable meeting on Wednesday, Nov. 19, at the North Surrey Golf Club, by the courtesy of the Captain (Bro. A. R. Barford) and members, to whose hospitality much of the success of the meeting was due.

The "Davis" Challenge Cup, a very handsome trophy presented to the Society by W.Bro. Cyril Davis for annual competition, was the subject of the morning medal round, play for which resulted in a tie between W.Bro. H. W. Packham and Bro. G. D. Bidwell, the latter being the winner last year. In the afternoon the foursome bogey competition was won by W.Bro. Oswald and Bro. Bidwell.

W.Bro. A. E. Broadberry, after presenting prizes to the successful competitors, referred to the sincere regret with which the members would learn that W.Bro. H. W. Packham, who had so admirably discharged the duties of Hon. Secretary to the Society for so many years, felt compelled to relinquish that office. In briefly responding, W.Bro. Packham nominated Bro. A. H. Henry as his successor.

THE EDUCATION SCHEME.

By WALTER HOLE, Organizing Secretary.

At the meeting at which the Education Scheme was accepted by the Institution of Gas Engineers, it was stated that with this, as with most pieces of complicated machinery and plant, experience would probably show the necessity for modification or adjustment in this or that particular. Twelve months' working of the scheme has shown the accuracy of that forecast. It is, however, a remarkable commentary on the thoroughness with which the work was done in the first instance, that in all essentials the scheme has well stood the test of experience. The modifications proved necessary are those of detail, and not of principle or framework. The Advisory Committee have therefore been busily engaged in incorporating in the scheme those improvements which experience has proved desirable.

PUPILS OF GAS-WORKS PLANT MANUFACTURERS.

One of the difficulties encountered has been in connection with the pupils and staffs of the manufacturers of gas-works plant. Some of these men are highly-trained engineers, occupied in designing, erecting, and in some cases supervising for some time the actual working of new plant. Many of these men are looking forward to entering the industry proper as gas engineers, and naturally wish to equip themselves to the fullest possible extent by preparation for, and success in, the examinations held under the Institution's Scheme, before their student days are passed. The industry looks on and welcomes them as a most valuable class of recruit. The difficulty has reference to gas-works experience. It is an axiom that such experience, over an extended period, is an essential, if certification is to be of value. The case of those who have been repeatedly engaged, over prolonged periods, in the supervision of the working of new carbonizing plant is comparatively simple to deal with. The Committee recognize that some of these men may, in this way, be receiving a far wider experience, and getting a much greater grip of detail, than is possible in many other instances where the experience is of a more routine character. Therefore, in cases where the Advisory Committee are satisfied that this experience has actually been of a sufficiently extended character, they have decided to admit to examination those who satisfy the other conditions, and to certify all such successful students. It is obvious, however, that such experience will probably be so varied that no general ruling can be given. Each individual case must be decided on its merits.

THE INTERIM CERTIFICATE.

The problem of the man who has only had drawing-office experience, or experience as an erector, or both, but who has not been engaged in the actual working of carbonizing plant, presents more difficulty. Many such men wish to qualify themselves for entrance into the industry by taking gas engineering courses. But the Institution could not certify as practical gas engineers men who had little or no experience in the day-by-day detail of the routine of a gas-works whatever their technical training in pure engineering. A first-hand knowledge of the difficulties ordinarily met with, and power to deal with the emergencies continually cropping up, are of course vital, and can only be obtained by actual personal contact with them. The Education Scheme, therefore, very wisely restricts certification in the Higher and Diploma Divisions to those actually engaged in the practical (as distinguished from the clerical) work of the industry. The question was, how to bring these men within the scope of the Scheme without weakening the safeguards or depreciating the value of the Certificate when won. This problem has been solved very satisfactorily by a happy inspiration of the Chairman of the Advisory Committee. Such students will now be admitted to the examination, and, if successful, will receive a letter, signed by the Chairman, certifying that the examination has been passed. This will be, in effect, an interim certificate, and could be used by the holder in applying for a post in the same way as an Ordinary Certificate might be. It may therefore very well prove a valuable passport into the industry. When, either as a consequence of entering the industry or in other ways, the Committee are satisfied that a sufficiently extended practical experience has been obtained to justify them in doing so, the Chairman's letter will be exchanged for a properly endorsed Certificate. It resolves itself therefore into this: That the examinations may be entered for by such special students, that if successful an Interim Certificate will be issued, which will be superseded by the regular Certificate, when, in the discretion of the Committee, the student's practical experience has been such as to enable them to grant it.

TIME ALLOWED FOR EXAMINATIONS.

At the examinations held last May, many candidates found the time allowed (four hours) far too short to enable them to deal adequately with the questions set, and particularly where these involved drawing or sketches. The Board of Examiners, while making all allowances for the disturbing atmosphere of the examination room, are wisely determined to exact a high standard in the quality of the papers passed. It has been decided, therefore, largely on the representation of students themselves, that in future, in the Higher Grade and the Diploma Examinations, the present allocation of one sitting of four hours shall be superseded by two sittings of three hours each, giving six hours in all, and introducing a very welcome break midway. The full question paper will therefore be divided into two sections of five questions each (of

which four only may be attempted) which will be taken at the first and second sittings respectively. The further question then arises as to whether these examination sessions should be held in the morning and afternoon or the afternoon and evening. The Committee are anxious to meet the convenience of intending candidates on this point; and an endeavour will be made after Christmas to elicit an expression of opinion from those concerned.

EXAMINATION FOR THE DIPLOMA.—REQUIREMENTS FROM CANDIDATES.

In connection with the examination for the Diploma, two difficulties which presented themselves have been successfully surmounted. In the Scheme as originally adopted it was stipulated that the Diploma should be restricted to those who have obtained the Higher Certificate in both Gas Engineering and Supply. The Higher Certificate could only be awarded to those who are actually engaged in the practical work of gas manufacture or supply. In actual operation this stipulation, well-intentioned as it undoubtedly was, worked very hardly and kept out desirable entrants. In the larger undertakings work is so greatly specialized that it is often impossible for a works student to obtain an extended experience on the supply side. On the other hand, it is in most cases absolutely impossible for the supply man to obtain the necessary experience of works practice. In the smaller works this difficulty is non-existent, as pupils and important members of the staff may be engaged indiscriminately on both. The effect therefore was to exclude the students from the larger undertakings—the very class it was most desirable to include—from the possibility of obtaining the Diploma either in Engineering or Supply. The difficulty has been met by a slight amendment of the above requirement. This now provides that the candidates for the Diploma in Gas Engineering must possess the Higher Certificate in Gas Engineering and the Ordinary Certificate in Supply, and conversely that the candidate for the Diploma in Gas Supply must possess the Higher Certificate in Supply and the Ordinary Certificate in Gas Engineering. The point of this is that no restriction as to actual day-by-day experience is insisted on from candidates for the Ordinary Grade Certificate.

THE UNIVERSITY STUDENT.

The case of the university student presented more difficulties. These were twofold. If in the requirements for the Higher Certificate examination practical experience is very properly insisted on, it becomes still more essential in the case of the Diploma. The actual works experience of the possessor of a Degree in Gas Engineering may, however, be very limited, or at any rate too restricted to warrant the highest certification the industry can give. The matter of experience therefore presented the first difficulty. The second was even more serious. It was felt to be impossible to ask the man who had undergone a course of highly-specialized training at a university like Leeds, to go back and take the Ordinary and Higher Grade Examinations in order to qualify himself to take the Diploma. Such a course would, quite naturally, be considered to be *infra dig.*, and one to which no self-respecting student could be expected to submit himself. Even apart from the personal question, the waste of time and expense involved would be wholly unjustifiable. These two difficulties have happily now been surmounted, largely under the inspiration and advice of Prof. Cobb, by the introduction into Section III. of the Education Scheme of a new paragraph, which reads as follows:

> "A candidate for the Diploma who has taken an approved Degree in Gas Engineering in a British University shall not be required to take a further written examination, but shall be required to present a thesis, or published work of his own, to submit himself to a *viva voce* examination, and to produce evidence of professional experience satisfactory to the Committee."

It is hoped and believed that this modification will open the way for the linking-up of the work of the Universities with the Education Scheme by providing acceptable means for the graduate to become possessed of the Diploma of the Institution.

THE PARTIALLY SUCCESSFUL CANDIDATE.

An extremely valuable concession has also been made to candidates for the Diploma in the matter of the examination. As originally drawn up, the Scheme contemplated the passing of the candidate in each of the three sections of the examination at a single attempt. The question arose in connection with the last examination whether any candidate failing in his written examination, but presenting an acceptable thesis, should be failed altogether, and thus have to prepare another thesis at the second attempt, or whether the same thesis might not be accepted for the following year, provided the candidate was then successful in the written portion of the examination. On the other hand again, the reverse of this was considered—namely, the case of the man who passed in the written portion of the examination, but failed so far as his thesis was concerned. It has now been decided that any candidate failing in either the written portion of the examination or in the thesis, may be admitted to the examination in the following year in the section in which he previously failed, and that, if then successful, he should not be required to take again that portion of the examination which he had previously passed.

LIMITATIONS TO THE CONCESSION.

If it is desired to take advantage of this provision, however, the second attempt must be made in the following year; the concession being limited to that extent. Also, it must be clearly understood that the *viva voce* portion of the examination has relation equally to the written portion and the thesis, and that therefore each candidate will be required to present himself for the oral examination at the second, as at the first, attempt.

The above amendments have, of course, to come before the Council of the Institution for confirmation; but as they have been passed unanimously by the Advisory Committee, it is hoped that no difficulty will be encountered at that stage. The last date for receiving applications to sit for the Diploma Examination is Dec. 31 next; and to have withheld public intimation of the above modifications would probably have prejudicially affected the number of entrants.

THE COLONIES.

It is gratifying to all who have this question of education at heart to learn that interest in the scheme has spread to our Colonies, and that inquiries as to possible participation in the next series of examinations have been received from students in Australia and New Zealand.

ELECTRICITY SUPPLY MEMORANDA.

Lighting Revival.

THERE is further evidence of the revival of attention to the lighting business in the electricity industry. It is found in a discussion at an "extra" salesmanship conference called in response to a request for the repetition of the interesting lecture by Mr. W. E. Bush on the subject of an intensified lighting campaign. This was the paper noticed in the "Memoranda" on Oct. 15. On this occasion Mr. J. W. Beauchamp, the Director of the Electrical Development Association, presided. He made a shrewd remark in opening the proceedings. It was to the effect that the revival in the development of electric lighting should be encouraged as much as possible, because it was the one thing the industry gave people which they understood, or thought they understood. In his opinion, if lighting is constantly kept before the public, then they will accept much more readily the other things the industry has to offer. Recently, he admitted, electricity suppliers have taken lighting for granted, and have neglected it. But this is going to be altered. The intelligence is interesting, because some foolish electricians have been writing and saying that gas lighting is not to be found anywhere to-day, and that everybody regards the electric light as the only pebble on the beach. But the fact remains that only about 8 or 10 p.ct. of the houses of the country are wired for electricity; therefore the rest have to obtain their artificial lighting from another source. Part of the top layer of lighting requirements has been appropriated by electricity; but the supply undertakings find it a more difficult task to obtain the substantial layers underneath. And with the improvements in gas lighting, and house to house inspection and maintenance schemes, they find it no easy task to make headway in the business.

Financing Wiring—Hire-Purchase Scheme.

This task hinges on the question of finance. It is thought that wiring and equipment should be done on the hire-purchase system. But there are divided opinions as to who should do this, which shows that there is not any vast confidence in the profitableness of the scheme. Some think the contractors should undertake the financing, which in our opinion is a ridiculous proposition, seeing that the electricity supply people are the ones who have continuous business with the consumers, and who can therefore most readily command and collect payment of the purchase rental. But the fact is many electricity suppliers are mightily afraid to do anything to swell consumers' accounts outside the charge for current. They talk a lot in the electricity industry about psychological effect, and one such effect that they abhor with deadly earnestness is the impressing of consumers (more than is unavoidable) with the dearness of all things electrical. To add hire-purchase to their accounts would not help them on the point of boasted, but not guaranteed, economy. However, while one speaker thought the supply undertakings should find the capital necessary for extending installations on a hire-purchase basis, others urged that the contractors should do it. One inventive mind suggests that, in view of the fact that small contractors could not individually finance such schemes, they should form small limited liability companies for the purpose; but another positively said that contractors were not prepared to lay out money on such business as easy-payment systems. For them there would not be anything in it; and there would be a good deal of work involved, and risk. They cannot afford the risk. What they want is definite jobs at definite prices, collecting their money in a lump sum at the end of the work. Electrical contractors, too, carry on a competitive business; and some are more successful than others. Those who are the more successful are the ones who would benefit most—if benefit there would be—from an amalgamation for the hire-purchase business. The brilliant suggestion was also made that electricity supply concerns should provide and finance a hire-purchase scheme for wiring; but that, before doing so, they should call together the contractors, and settle details as to prices for wiring, and then the contractors could go ahead and

canvass for orders. We do not think anything much is coming out of the proposals. That they have been made, points to the fact that electric wiring and equipment is beyond the pockets of the general run of householders.

Sectional Concentration and Education.

There were two other outstanding points in the discussion. It was strongly advocated that, in the campaign for the development of the lighting business, one section of the business should be taken at a time; and the general feeling was that the extension and improvement of shop lighting was the direction in which there should be initial concentration. The reason shop lighting is suggested is that this has good advertising power. That depends on how it is carried out. We have seen some shop lighting by electricity that repels rather than attracts; if it attracts, it is because the lighting is properly done, and that costs money. There was further advocacy of electrical salesmen being educated in scientific lighting. Some are being educated now; and these are admitting that education is showing them how little they knew before of the technicalities of the work. There has been much talk as to educating the public; but there is ample evidence of one great need of the industry being the education of the salesmen themselves. We are thoroughly in agreement with this, inasmuch as very absurd things are noted from time to time in the electrical prints which are attributed to electrical men. Some of these are so palpably false that they show either a deficiency of mental power or no aversion to exceeding the limits of truth. On the other hand, we admit that, if the consumers were electrically educated, they would know better than to buy the cheap and nasty goods which are offered to them, and which in the long run are very costly.

The Regulations Again.

There is no reason for offering excuse for referring again to the controversy in the electricity supply industry over the revised wiring rules and regulations of the Institution of Electrical Engineers. The position is interesting because the industry shows that, in this matter, it is divided very much in opinion. The question is reduced to one of expense; and even on that point there is no positive agreement. Scant consideration is given to policy and permanent advantage. Here we have a composite Committee spending a large amount of time on the revision of the regulations, and agreeing that the best interests of the industry will be served by the standard of requirement laid down in their work. After their voluntary labours, their searching investigation, and judgment on all points, one section of the personnel of the industry declare themselves prepared to tear up the rules and scatter them to the four winds, because, in their opinion, they will add to the expense of installation, and so retard new custom. But what matters if greater safety and efficiency in service are to result? Those qualities in the long run would have greater value for the industry. The published correspondence on the subject shows beliefs that are wholly opposed to one another. On one page of the "Electrical Review," there is illustration of this. In a letter by Mr. H. Wilson, of Ashford, he says that he has come to the conclusion that to insist on the adoption of the rules "will increase the cost of wiring, and will retard the general use of electricity." We doubt very much whether Mr. Wilson has had the large and varied experience in wiring that Messrs. Marryat & Place have had, and whose views on the subject must be accepted as possessing good authority. They refer to the fear that the adoption of the rules will considerably enhance the cost of installations; and also to the statement of one writer that electrical contractors are averse to the new rules. As to the latter, they say that they do not think this is so—certainly not among the contractors with whom they come in contact. As to the cost, Messrs. Marryat & Place suggest that before anyone condemns the regulations on the score of increased cost, he should carefully investigate what this means as a percentage on the total cost of installation. They have taken out the figures, and find the increase is so small that it will not affect the price at all. Admittedly there are a few items which will at first cost substantially more, but even these may be expected to come very much into line with present prices as the demand increases. The concluding paragraph of their letter is well worth noting: "We think that contractors generally are satisfied that without a standard set of regulations of this sort which can be adopted by supply engineers, we should quickly drift back into the chaotic and ultra-expensive conditions which existed in the past, and which exist in some parts to-day, where each engineer on the supply side sets up his own special code." Perhaps supply engineers may make investigation to ascertain whether, in view of the attitude of contractors of position, they have not been jumping at conclusions, which have not actually the solid foundation that from superficial examination they believed to exist.

The Power of Imagination.

The writer of notes under the heading of "The Electrical Trader" in "Electrical Industries" informs readers who are unaware of it that "the heating season is now in full swing." His resources for obtaining news must be very complete; for he asserts that from practically everywhere come very encouraging reports of excellent business—that is to say, in electric fires. If this is so, there must be a considerable number of people with little sense and a large amount of money to squander. There is congratulation to those traders who anticipated this outburst of electric heating business, and based their stock orders accordingly. "The areas in which electric heaters can be hired have been added to this year; and some of them are frankly astonished at the demand." It is not clear whether it is the areas or the heaters that are astonished. It cannot be the contractors, for they do not do business in electric heaters on hire terms. There is also a little protest against the stealing of the designs of one maker by other makers. The slavish copying has been so glaring in some cases this year that our contemporary feels that one or other of the associations ought to take some steps in the matter. We suppose he means by doing something to protect the originators of new designs. Imagination is certainly a valuable asset to some writers. As another instance of the foolish writing circulated in some of the electrical papers, one may quote, from the same informant on matters electrical, the following ridiculous paragraph:

> The electric cooker business is still progressing in a highly satisfactory way. We hear rumours of combined gas and electric cookers now being made up for testing. Where the rates for electricity for cooking cannot be brought down to competitive ones, this may be a temporary solution of the cooking problem; but with the penny rate that is getting quite common now (and there are some lucky areas enjoying electricity at even lower rates), we do not see any necessity for helping our competitors to an additional lease of life by this method—but perhaps the experiments are being made by our rivals themselves! If that is so, then indeed can we congratulate ourselves.

The gas industry is not so hard up for business that it requires such assistance from the electricity industry; but we do know that the idea for utilizing gas for hotplates on electric ovens was of electrical origin, because the inefficiency of the electric hotplate needed the help of the gas industry. But householders are not likely to tolerate two heating services to one cooker; and there will be paltry patronage of the electric cooker, with the hotplate efficiency very little in excess of 40 p.ct. (when new), and with a KW.-H. being only equal to 3420 B.Th.U.

Automatic Regulation of Generation.

By co-ordinating the work of generating sets so that every machine operates to its maximum capacity, there can be a large economy in fuel and a great saving in money. That is the good news for electrical engineers which comes from Paris; and we find it in the notes of the Paris Correspondent of the "Daily Telegraph." If it be true, the new knowledge will, it is asserted, save France a milliard francs a year in fuel! Over this news electrical engineers will greatly rejoice. It was divulged in a paper presented to the Academy of Science by M. Rateau on behalf of the inventor, M. Doloukanoff. According to the "Telegraph" correspondent, it is a device for the automatic regulation of the power output of any electrical plant which consists of more than one machine. "It is based on a fact well known to electrical engineers, but hitherto never applied in practice, that a power-generating plant proves very wasteful of fuel unless it is run so as to give something like the maximum output. Where a plant comprises several machines, therefore, it should be so regulated that each machine is giving its maximum return so long as it is running." The inventor's device automatically distributes the work so that each generating set runs to its full capacity when working, while the others remain inactive. It is declared that, applied to the plant which furnishes current for lighting in Paris, the Doloukanoff system will save 250,000,000 KW.-H. a year, which represent an economy of 250,000 tons of coal! Wonderful! That is based on a production of 1000 KW.-H. per ton.

Fatal Electrical Accidents in Mines.

According to the report of H.M. Electrical Inspector of Mines (Mr. J. A. Bernard Horsley) for the year 1923, there were fourteen fatal accidents, causing the loss of fifteen lives, attributable either directly or indirectly to the use of electricity. Two of these occurred on the surface, and twelve below ground. Of the deaths, ten were directly due to electric shock, three to ignition of methane, one to the explosion of an oil-break circuit-breaker, and one to injury received from a rotating drill, following an electric shock. The number of deaths directly due to electric shock below ground during the last seventeen years, in mines, is as follows: 1907, 10; 1908, 12; 1909, 13; 1910, 15; 1911, 9; 1912, 7; 1913, 13; 1914, 4; 1915, 8; 1916, 4; 1917, 2; 1918, 6; 1919, 6; 1920, 3; 1921, 1; 1922, 6; and 1923, 9.

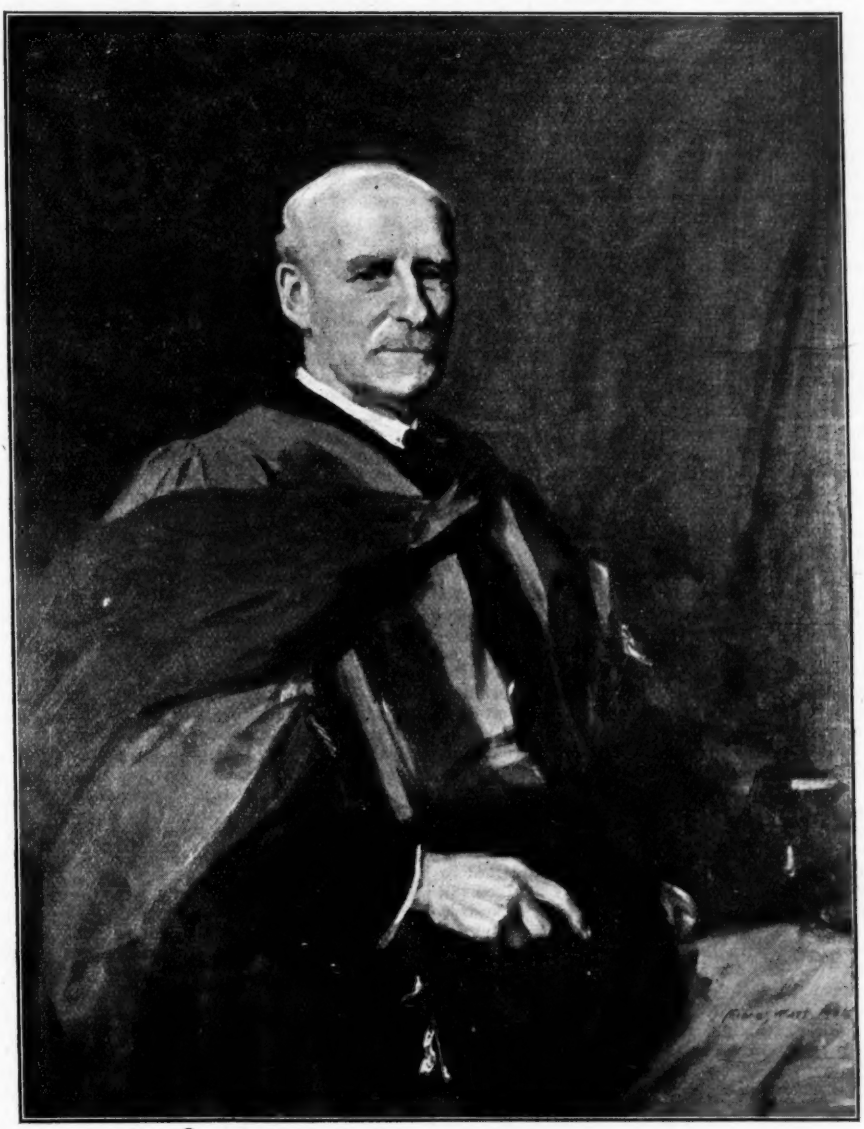
Will's "Electric Lighting."—From Messrs. Butterworth & Co., Bell Yard, Temple Bar, London, we have received a copy of the fifth edition (by J. C. Dalton) of "The Law Relating to Electric Lighting, Power, and Traction," by His Honour the late Judge J. S. Will, K.C. (Joint Author of Michael and Will's "Law Relating to Gas and Water"). The new edition is published at 42s. net.

Manchester and District Junior Gas Association.—The next meeting of the Association, on Saturday, Dec. 6, will take the form of a visit to the Bradford Road Works of the Manchester Gas Department. The visit will be followed by a paper by Mr. W. B. Payne, of Liverpool, on "The Distribution Department." Members should assemble at the main entrance to the works at 3 o'clock.

PROF. ARTHUR SMITHELLS HONOURED.

Presentation of a Portrait and a Scholarship.

There was a large gathering of officers, staff, and students and outside friends on the occasion of the presentation to the Leeds University of the portrait of Prof. Arthur Smithells, C.M.G., D.Sc., F.R.S., who resigned last year from the Chair of Chemistry at the University—a position which he had held, in the University and in its former state as the Yorkshire College of Science, for a total of 38 years. The gathering took place in the Great Hall of the University on Nov. 25. As a mark of appreciation of Prof. Smithells' great services to scientific education and research in Yorkshire, a fund has been raised since his retirement, to provide a suitable memorial to his association with the University. The fund reached a total of £2462, and has been devoted partly to the painting of a large portrait of Prof. Smithells, by Mr. Fiddes Watt, A.R S.A., which is to be hung in the University; and there has also been founded the Arthur Smithells Scholarship of about £100 per year.



PROF. ARTHUR SMITHELLS, C.M.G., F.R.S., D.Sc.
FROM THE PORTRAIT BY FIDDES WATT, A.R.S.A.

The Pro-Chancellor of the University (Mr. E. George Arnold) presided over the gathering, and Prof. J. H. Priestley (Joint Hon. Secretary of the fund with Prof. J. W. Cobb) read letters of regret for unavoidable absence from Sir Hugh Bell and Prof. T. Wardrop Griffith (senior member of the Senate since the resignation of Prof. Smithells) and others.

The PRO-CHANCELLOR referred to Prof. Smithells as one of the foundation stones and principal pillars of the University.

PRESENTATION OF THE PORTRAIT.

Mr. A. G. LUPTON, Treasurer of the fund, and Pro-Chancellor of the University during most of the time of Prof. Smithells' tenure of office as Professor of Chemistry, formally presented the portrait, and also the Scholarship Endowment Fund. When the Yorkshire College of Science first opened its doors in 1874 it had three professorships only. The Chair of Physics was held by Prof. Rucker (afterwards Sir Arthur Rucker), that of Geology and Mining by Prof. Green, and that of Chemistry by Prof. Thorpe (now Sir Edward Thorpe). When, in 1885, Prof. Thorpe accepted the Chair at the School of Science, South Kensington, Prof. Arthur Smithells was elected his successor, and for nearly 40 years past he had devoted himself to the University. The long list of old students and friends in all parts of the globe who had at once responded to the appeal for this memorial of Prof. Smithells' association with the Leeds University was great testimony to the influence of his work during those years; while the generous contributions of the gas industry showed the high estimation in which the scientific assistance he had given to that industry was held. The Yorkshire Ladies' Council had also desired to be associated, in recognition of Prof. Smithells' great interest in and assistance to the work of the Training School of Domestic Science. The University as a whole had been his life's work; but it was of that side which came specially before him (Mr. Lupton) that he wished to speak more particularly. In 1885 the Yorkshire College was a comparatively small and struggling institution, though full of vitality and growing rapidly in both numbers and importance. In the constant process of evolution, broad questions of policy had had to be considered, and decisions taken involving big issues; and on all occasions the Council had been able to call for and to

rely on the judgment and loyal assistance of Prof. Smithells. Few things had gone on in the history of the College and the University without Prof. Smithells being called upon for advice and help. It was well known that service to the University had been his first and only consideration, without thought of self. This, remarked Mr. Lupton, had been relied upon perhaps to an unfair extent; but Prof. Smithells had never failed to take up the additional burden.

Situated in a great manufacturing area like that of Leeds, it was natural, said the speaker, that applied science should be the pre-eminent side on which development took place; and the influence and judgment of Prof. Smithells had been of the greatest value in that development and in the choice of the eminent group of men who occupied the Chairs of the University and who had made its position in the estimation of those who knew and who really counted. It had been his (Mr. Lupton's) privilege to be associated with that side of Prof. Smithells' work; and it was a great gratification to all of them to know that when the present generation had passed away Prof. Smithells' name would be perpetuated in the Leeds University by the Scholarship, while his portrait would take its place in the Hall alongside others whom the University held in such affectionate regard. Mr. Lupton said that in presenting this portrait he would like to thank the artist. The Committee had felt considerable responsibility in the matter. They desired not only a portrait which should be a satisfactory representation of Prof. Smithells, but one which should also be well worthy of the position in which it was to be hung. He thought it would be agreed that Mr. Fiddes Watt had earned their hearty congratulations on the result of his work—a work which entirely filled the expectations and hopes, on both these points, of those who put the work into his hands.

PROF. SMITHELLS' HELP TO THE FACULTY OF TECHNOLOGY.

Prof. J. W. COBB, Head of the Department of Coal Gas and Fuel Industries at the University, speaking as an old student and colleague of Prof. Smithells, and as co-Secretary of the fund with Prof. J. H. Priestley, said he was glad to have the opportunity of being associated with this presentation. His acquaintance with Prof. Smithells was of very long standing. Prof. Smithells had been Professor of Chemistry in his (Prof. Cobb's) student days. He had known him since as a colleague, and all the time as a great friend and adviser. It was, said Prof. Cobb, impossible on such an occasion to enumerate or even to summarize the valuable services which Prof. Smithells had rendered inside and outside the University in so many ways. Even confining oneself to University activities, it would be impossible to deal with them at all adequately, and to do justice to him, without telling the story of the University—so intimate had been Prof. Smithells' connection with all the main features in its development. There were, however, one or two things which he would like to emphasize. The record of Prof. Smithells, as the Head of the Chemical Department of the University—a department which had grown so much under his care—was one of which any man might well be proud. Its graduates were doing excellent work in Universities, schools, and in industry all over the world, and its reputation had gone steadily upwards. But the work of Prof. Smithells had meant much more than this to all of them. It was a great step forward when it was decided to leave no stone unturned in making Leeds a centre of university education, but it was important to bear in mind that what was done at that time was not simply to institute another university, but a new kind of university. To bring this about demanded knowledge, imagination, and courage—perhaps above all else, courage. The decision was made that in this new University not only should science have a place of honour, but that a Faculty of Technology should be included, ranking alongside Arts, Science, and Medicine, and maintained in the closest possible union with them. This was based on an essentially new idea that the principles operative in industrial processes so important in this country—and particularly in their part of the country—could be made perfectly fitting subjects for university study, training, and research, if they were only treated in the proper way. It was a bold policy, and made the institution of the University very much of a pioneering venture. Its success had meant much to the industrial community and also to the University itself. It had meant bringing together people who, unfortunately, had come to regard themselves as having little in common; and to do this thoroughly, required the exercise of very special gifts in dealing with men and affairs. It had, however, been achieved. The story of this achievement could be told, and had, to some extent, been told very much better by Prof. Smithells than he (Prof. Cobb) could possibly tell it. But Prof. Smithells had always told it in a very impersonal way. This, he thought, was an occasion on which the personal side might justly receive more prominence, and an occasion on which the great part which had been played in this development by Prof. Smithells should be freely and fully recognized and emphasized.

With one department in this Faculty of Technology he (Prof. Cobb) was particularly connected; and he knew what the work of Prof. Smithells had been in connection with the gas industry. He also knew how very fully that work had been appreciated in the industry. Mr. Ferguson Bell, the President of the Institution of Gas Engineers, was there to speak on that subject. Of course, the sort of development of which he had been speaking was not one for which any individual could be held solely responsible, nor had it been the work of academic men alone. Nobody had spoken more strongly to that effect than Prof. Smithells himself. He had always insisted on the importance of the lay element in the University. This duality of personnel, with unity of effort, was very happily symbolized on this occasion when the portrait of Prof. Smithells was presented to the University by Mr. Arthur Lupton, who was Pro-Chancellor of the University during most of the period of Prof. Smithells' work there, and when this portrait was to be received by the Pro-Chancellor and Vice-Chancellor together, who were now undertaking the great responsibility of the University's further development. Prof. Cobb said he would not like to conclude without saying a little about the unique position which Prof. Smithells had held in the University for so many years in relation to the staff and students. Nobody, he thought, had been the repository of more confidences. Nobody had been so much called upon for advice, or had been at more pains to give it to the best of his ability, drawing upon a rare faculty of judgment and a wealth of experience for the purpose. It had enabled many of them—he would not say to avoid the pitfalls of university life, because this had a sinister implication which was not intended—but to understand and appreciate its peculiarities. Friendliness and hospitality had been freely bestowed; and in this connection he thought it would be an unpardonable omission if he were not to couple the name of Mrs. Smithells with that of Prof. Smithells. (Applause). Prof. Cobb said he would like to express a feeling, which they all must share, of gratitude to Mr. Fiddes Watt, whose genius had made it possible for them to place on the walls of the University that illuminating record in line and colour of a great personality and one of the University's most distinguished members.

SCIENCE AND CLASSICS.

Prof. D. M. CONNAL (Classics), speaking as a colleague of long standing and as a member of the Faculty of Arts in the University, said Prof. Smithells and he were very old friends. When he (Prof. Connal) came there in 1887, Prof. Smithells' was the first roof under which he broke the bread of hospitality. Since then they had worked together for some 36 years. They worked together and they played together, and they took counsel together, and they were friends. Besides his personal friendship with Prof. Smithells there was another reason why it had been thought desirable that he should speak on this great occasion, and this was because he belonged to the Faculty in the University which was least associated with the subjects of the Faculty of which Prof. Smithells had been such a distinguished representative. He (Prof. Connal) belonged to the Faculty of Arts, and his special subject happened to be that one which had been in the most direct opposition, in public opinion at any rate, to Science—he meant the subject of Classics. He (Prof. Connal) had come to the Yorkshire College at a time when controversy between Classics and Science was still very rife. That controversy was now more or less sleeping. At all events, they had agreed to lie down together in what peace they might. When he arrived at Leeds, Science was struggling to come into her own—and as much more as she could get. Those were the days when South Kensington was showering the blessings of scientific wisdom on a thirsty land, and producing crops of what were then believed to be rare and refreshing fruit. Prof. Smithells had never been an extremist, and had always gone on the principle of "live and let live." He did not take the narrow view that because the languages of Greece and Rome were dead their literature and history must be dead also. He recognized that, as it took all sorts to make a world, so it took all Faculties to make a University; and, further, he viewed with kindly tolerance—even with a certain benevolence—the growth and progress of the then struggling Faculty of Arts; for in those days it was not Science, but Arts, that was struggling for a place in the sun at Leeds.

If he were asked what were the two characteristics he should like to emphasize as distinguishing the work of Prof. Smithells, continued Prof. Connal, he would choose one which Prof. Cobb had already discussed—the way in which Prof. Smithells had taken such a great part in building up the Faculty of Applied Science, and in seeing that the proper emphasis was laid upon the noun and not upon the participle. The second thing was that he had always striven for complete unity in the University. In a place like this there was always danger that the different departments, not coming into close and constant contact with one another, might sometimes tend to develop centrifugal tendencies—one department might sometimes tend to set itself up as a kind of independent kingdom. They all saw the growth of sectionalism all over the world to-day. Prof. Smithells had always set his face against that in the University. He had felt that the various Faculties were members of one body; that their business was to strive not merely for their own individual subjects and interests, but for the interest of the University as a whole; that they should work together by mutual encouragement and by mutual criticism. And not only had he striven to bring them all together, but he had also done his best to bring the students into close connection with the staff, and to give them a greater feeling and pride in the University. He (Prof. Connal) knew, perhaps as most students—especially the present ones—did not know, how much Prof. Smithells had done for them in the early days in the way of bringing them together and emphasizing the importance of tradition, and in helping to build it up. As man of science, as teacher and educator, as administrator, as man of affairs, Prof. Smithells had played a most distinguished part in the College and University; and no one more richly deserved, by the greatness and the

prominence of his service, to be held in lasting remembrance. (Applause.)

ASSOCIATION WITH THE GAS INDUSTRY.

Mr. J. FERGUSON BELL, M.Inst.C.E., President of the Institution of Gas Engineers, speaking on behalf of the gas industry, said it was a great privilege to be there on that occasion, and to take part in the presentation of the portrait to Prof. Smithells. He was glad to know that the industry which he had the honour to represent had subscribed practically one-half of the total sum of something like £2500 in grateful recognition of the valuable work carried out by their friend Prof. Smithells for so many years, which had certainly done so much to advance the progress of the gas industry. He had come there to voice the high appreciation of the gas industry for all the generous work that Prof. Smithells had done, and the result of which had been very real progress in scientific learning, whereby practice and science had become more united than they were a few years ago. The money entrusted to Leeds University had been most economically and wisely spent in a manner which would be a stimulus for further efforts to provide additional monies by the aid of which the Senate might further increase its work in scientific industrial research. The Leeds University Research Sub-Committee, of which Prof. Smithells had been Chairman since its inception, and on which he was very ably seconded by their friend Prof. Cobb, and assisted by a loyal band of workers, had issued twelve very valuable reports giving the results of a series of experimental investigations carried out under the auspices of the University, results which otherwise it would have been impossible to effect. Mr. Bell thought it was impossible to exaggerate the importance of doing everything to promote research aiming at the proper utilization of fuel. They could see on all sides—especially in their great industrial centres—what the waste of coal was doing. He did not desire in any way to under-value the great work achieved by the ancient seats of learning, but this he would venture to say—and he thought he could say it without any offence—that the Leeds University had more than justified the most sanguine expectations of those leaders by whose foresight and generosity they were able to be there that day. They had heard that when the University was first established it was to be a new kind of University where Science was to be given its proper place of honour. The University, he believed, would be known in times to come as one which had paid special attention to scientific investigation connected with various industries; and he did not think any more important work could be carried on at present than that of experimental investigations. They knew that Prof. Smithells had been connected with that University for nearly forty years. Not only was he a distinguished scientist and an attractive personality of sterling character, but it was no exaggeration to say the University occupied its present high position largely owing to his untiring labours. He was admired and honoured in the gas industry for the work he had carried out. The industry recognized the great importance of the fact that in the future there must be closer co-operation between science and practice. Prof. Smithells would long be remembered in Leeds for his personal charm and his high sense of duty towards the University and all it took in hand. He (Mr. Bell) could not do better than draw attention to the report by the Advisory Committee for Science and Industrial Research for the present year, in which the Committee said: "Scientific research is the main, if not the only, source of fresh productivity in industry; and it is only by increased productivity that the world will find the way out of its present economic difficulties." It was to Universities such as the one at Leeds that industry looked for the close co-operation by which they all hoped to advance. The gas industry rejoiced to know that, though Prof. Smithells had left the University staff, his services would still be available for the benefit of scientific advancement. It was typical of the man whom they were there to honour that the splendid portrait now being presented should be presented to the University to which he had given so much of his life. There was no more fitting place than the walls of that great University for the picture to adorn, being the companion of those of other distinguished members who had helped to make the University what it was to-day. He was extremely glad to know that in addition a Scholarship had been founded of the value of about £100 per annum. It was with the greatest pleasure that he expressed the gas industry's acknowledgment of, and thanks for, all that Prof. Smithells had done, and all that had been done for the industry by Leeds University.

A FINE EXAMPLE.

The VICE-CHANCELLOR of the University (Dr. J. B. Baillie), speaking on behalf of the University, said he was proud and glad to take custody of the portrait of one who, while he might split the flame in the laboratory, had always kept alive the light of truth in his work in the University. It was very important that from time to time they should keep fresh and faithful the memory of those who had rendered distinguished service to education. Education lived largely by example; and no better example had been presented for the young than that of one who had devoted the best interests of his life not merely to the University, but to the welfare of the Science which he adorned. There was no object of greater admiration by the young than successful achievement. Moreover, it was desirable that in a University of this character they should keep up a continuous connection between the past and the present; and there was no better way than by gradually accumulating a collection of portraits of distinguished men in the University. On all these grounds they were proud to possess this portrait of Prof. Smithells. His enthusiasm for Science justified the admiration of those who had joined together to present his portrait to him. His affection for the University warranted their preserving the portrait in honour for all time. His distinction as a scientist would add distinction to the collection of portraits now upon the walls.

PROF. SMITHELLS' REPLY.

Prof. SMITHELLS, responding, was very warmly received. "I have had in my time," he said, "some hard tasks to face in this University, but never one quite like this. Mr. Ferguson Bell asked me as we came in if I liked living in London, and I said 'Yes, very much.' I only wish I was there now." (Laughter.) It was, of course, went on Prof. Smithells, impossible for him to prepare any remarks beforehand in which to express adequately his appreciation of the kindness which had been shown to him that day. He hardly knew what to say, but he felt that he must take in detail the names of those who had spoken so kindly and generously, and allude in a few words to what they had said in such embarrassing terms about himself. "To you, Mr. Pro-Chancellor, I will say this: You have not been with us long, and you cannot know, but others here will know, how much comfort it is to me to know that you are in the chair which was made illustrious by my friend Mr. Arthur Lupton. Mr. Lupton is one of the best of a great family which has represented to me the pious founders of this University—the good citizens of Leeds and Yorkshire. He represents to me those men of enterprise and foresight and generosity who brought together the first teachers of what is now the great University of Leeds. It has been my privilege to work by the side of Mr. Lupton—mostly cheerfully, I hope; sometimes with anxiety. It has been a great privilege to me to have had his companionship all these years. Our ties have been very close. When there have been times of anxiety and disappointment, as must arise for every man, and when temptations have come from outside that might have induced me to seek some other sphere for my work, it has been enough for me to know that Mr. Lupton wished me to stay. I can assure you that the honour that is being done to me to-day is greatly and preciously increased by the knowledge that my portrait will hang in the same hall as will contain that of Mr. Lupton. Prof. Cobb typifies to me the students' community in which I have worked. He is one of the great band of students of this University who have risen to eminence. It is pleasing to me to know that I have been able to contribute something to their success. It is immensely gratifying to me to see them rise, and particularly those who have risen to occupy high positions in the University of which they were themselves students. It is especially gratifying in the case of Prof. Cobb, to see in him what my ideal of a professor of applied science should be. I could not tell you what happiness I have found in my intercourse with the students here."

Many people, continued Prof. Smithells, would probably be curious to know how he had come to be so much identified with the gas industry, and why the industry had contributed so generously to this fund. It was all very wonderful, and yet very simple. His scientific work was concerned largely with the phenomena of combustion, and at an early stage of it the gas industry asked him to talk to them about the subject, which, of course, was of great importance to them. He did his best on that occasion, and thus began this long and friendly association. He became intensely interested in the problems facing the industry, and saw the possibilities of the application of science. A great deal had been done, but he felt a great deal more was wanted. Any overtures he made to the industry were responded to generously by the representatives of its organizations; and so the association between them to-day came about in the most natural way. He was always the accredited agent of the University, and through him the gas industry was honouring the Leeds University that day. It would be hypocrisy on his part to disguise his recognition of the personal element in the honour. He could not but feel this, because he knew he moved in the industry among a multitude of real friends. If he had been able to escape some of the frailties of men living within the walls of a University, it was because he had been so much in contact, through the gas industry, with men who lived in the wider world. There he had learned a certain amount of tolerance and sympathy which perhaps he might not have otherwise attained, and which had helped him to do his work better than he might otherwise have been able to do it. He was greatly honoured to know that Mr. Ferguson Bell, the President of the Institution of Gas Engineers, should have come all the way from Derby to speak on this occasion; and he rejoiced very much that it was still possible for him to go on helping the industry a little on the path on which they were progressing so well and with ever-increasing advantage to the community.

HUMANIZING INFLUENCE OF THE UNIVERSITY.

Prof. Connal had referred to early days in Leeds. Prof. Connal had always been a difficult subject to deal with. (Laughter.) They had commenced at the University together as very young men—young, and speaking for himself, enthusiastic, arrogant, intolerant, narrow-minded; possessing, indeed, all the natural characteristics of healthy youth. (Laughter.) When he thought of the time that had passed since then, he could not help but think how much the University had civilized him, so far as he yet had any civilization. From the first the environment of

the University exercised a wholesome influence on those who worked within its walls. He had known all the men who had first worked there as teachers; some of them intimately. When he came there, there was already a great tradition; they could never fully express their recognition of the fact that the University was started under four great men of science, foresight, and quite exceptional generosity of mind—Green, Rucker, Thorpe, and Miall. Of them only one, now Sir Edward Thorpe, remained, active in mind, but unhappily frail in health. He knew Sir Edward Thorpe before he (Prof. Smithells) became Professor at the University. Sir Edward had always been his friend; and when he left Leeds he left to his successor a chemical department which any man might be proud to enter. Of all men with whom he had been associated in the University there was one to whom he could never give his due. He meant the late Prof. Miall, one who did more, he believed he could say with perfect truth, than any other man, for the spirit of the University. There was no man from whom he had had the opportunity of learning so much of how life should be lived as from Prof. Miall; and he liked to think he had profited from his companionship in the work they had done together. Speaking of more recent colleagues, Prof. Smithells said he had profited greatly from those in his own department. And where would he have been, so far as that department was concerned, but for the work of Julius Cohen, who gave to organic chemistry in the University such a position as it now occupied, and who was now the author of organic chemistry for the whole world where the English language was spoken? In his former pupil and friend, Prof. Dawson, who was responsible for the physical chemistry department, he had the most loyal ally any man could wish to have. He felt he must mention Mr. Lowson, a former student, and for so long his right-hand man. He did not know what he would have done without him; but he did know that without his reliable help and judgment he would probably have had to abandon much of what he had been able to do. He must make acknowledgment of all the help he had had from all his other colleagues. Prof. Connal had referred in terms of no great extravagance to his (Prof. Smithells') sympathies with the Faculty of Arts. He could hardly expect more from Prof. Connal. (Laughter.) He would like to take a little gentle revenge. He had been told he was to be consulted as to the spending of the money collected for this scholarship to go in his name. He hovered for some time over the possibility of allocating it to the furtherance of the study of Greek, not grammar but Greek literature. He thought of it because, resolute enemy as he had always been to the extravagance of the claims and demands and impossible positions associated with the ancient forms of culture, he had always recognized the great contribution which the Greek race had made to the service of mankind. It was to him deplorable to see how many people were growing up nowadays without any sort of knowledge of the history of the human race. He thought therefore that this scholarship might perhaps be used to encourage studies in a field which must certainly never be neglected if humanity was to get the best out of life. He had seen with satisfaction barriers removed, which had been set up by these studies; but he regretted the sacrifices which had been entailed, for it was deplorable that thousands of people should grow up with no knowledge of the greatest age in the intellectual history of the race. However, he had not proceeded with that idea of so devoting part of the fund. He was a science man, first and foremost, and must not be misled by what might be regarded merely as picturesque affectation on his part.

Prof. Smithells said he believed in science. It was really only just beginning, though it was going ahead with great rapidity. They were told by great authorities, including so great a literary man as Mr. Galsworthy, that the future of the race was in the hands of science. It was therefore natural that the scholarship should be devoted to the advancement of science. Prof. Smithells said he would like to take the opportunity of congratulating Dr. Baillie, the new Vice-Chancellor of the University, on his distinguished appointment, and to wish him very much happiness in the work. It was, of course, a position of great responsibility. He would have anxieties, and might make mistakes, but he was especially glad that, early in his career at Leeds, he should have been present on an occasion like the present, to see what a spirit of generosity and comradeship existed in the Institution. The new Vice-Chancellor, he was sure, could rely on the loyalty and sympathies of those around him, however short he might fall of the ideals with which he started. Personally, if he had his time to live over again and had the choice of a life's work, he would not make any other choice than that which had led him to his work at the University. He had been led by a great faith in the modern universities. He did not believe that knowledge alone, or that science alone, would save the world. It must be by temples of learning which were real temples—temples where they could inherit the wisdom of the past, and combine it with unity in a common bond of aspiration and service to the world in which men were born. If they preserved their freedom, resisting captivity of every kind, the modern university possessed more possibilities than anything he knew of helping to make the world a better place to live in. Before concluding, he wished to pay tribute to the artist who had painted his portrait. He could not see himself, so he was not sure whether the likeness was perfect or not, but he was assured by his wife that it was perfect; and what better testimony could one have than that of such a familiar critic? (Laughter.) He was not an artist himself, but he knew Mr. Fiddes Watt to be a great painter, and he had come to know him as a very good friend whom he hoped he would never lose. It seemed almost impossible that he had never had a dull moment during the sittings, but it was true nevertheless, for it had been a time of intense interest. It had been a revelation to him to see a great artist at work. He had had no idea what that work involved. Mr. Watt had been very kind to him on the whole, though at times he had treated him very severely! He wanted also to include his thanks to Mrs. Fiddes Watts, who had come in from time to time with words of comfort and good cheer and with welcome cups of coffee. (Laughter.) They would see that he was left without even a grudge against the artist, and only with a heart filled with gratitude to all who had been concerned in doing him this great honour. He was left with but a single regret—that it was quite impossible for him to make any adequate acknowledgment. (Applause.)

Mr. FIDDES WATT, called upon to speak, said he might be a painter, but he was no speaker. It was far easier to paint a portrait than to make a speech; and he could only thank all concerned for the kind remarks made about his work. It had been a work of great pleasure, and he wished to thank Prof. Smithells for the charming manner in which his behaviour in the sittings had helped him to carry the work through.

AWARD OF THE RUMFORD MEDAL TO PROF. C. V. BOYS, F.R.S.

The Royal Society have awarded the Rumford Medal to Prof. C. V. Boys, F.R.S., one of the Gas Referees. Respecting it, we have received the following letter and enclosures from the President of the Institution of Gas Engineers (Mr. J. Ferguson Bell, M.Inst.C.E.).

SIR,—This award by the Royal Society indicates the value attached to original scientific investigations carried out by Prof. Boys. The exact determination of the calorific value of gas is of the utmost importance to the gas industry; so I feel sure your numerous readers will be glad to know that, on behalf of our industry, the enclosed congratulation was sent to Prof. Boys, and will be interested to read his reply.

J. FERGUSON BELL.

The Gables, Derby,
Nov. 29, 1924.

[ENCLOSURES.]

"Dear Prof. Boys,—At a recent meeting of the Council of the Institution of Gas Engineers, attention was drawn to the award of medals for the current year by the Royal Society, and that the Rumford Medal was awarded to you for your invention of the gas calorimeter. I desire to offer you our cordial congratulations upon this recognition by those so well qualified to judge.

For many years you have been conspicuous among scientific workers in the extension and practice of accurate measurements. Apart from your invention of a new recording gas calorimeter, which, I feel sure, will be of the greatest advantage to both suppliers and users of gas, as I believe it is more accurate than those now in use, you were responsible for the elaboration of the instrument known as the radio-micrometer, the sensitiveness of which was secured by means of a specially fine quartz fibre, for measuring the radiations received from the moon and the stars.

I should like to mention your classical research on the Newtonian constant of attraction, and researches on soap films and their behaviour.

I believe this is the second occasion on which you have received a medal from the Royal Society; Lord Lister remarking on the last occasion "All his work is characterized by admirable adjustment of the apparatus he uses to give the best results. His instruments are indeed models of beauty and design."

The gas industry is honoured that so distinguished a scientist is one of the Gas Referees, and the members hope you may long continue to be one of the three our industry honours and respects for the impartial manner in which the difficult and responsible duties of Gas Referees are carried out. May I express the hope that these duties will be always entrusted to known scientists whose names are a guarantee that any Act of Parliament passed in respect of gas supply will be so administered as at least to command the respect of all interested

J. FERGUSON BELL.

Dear Mr. Ferguson Bell,

I must thank you for the very kind congratulations expressed in your letter of yesterday. The award of the Rumford Medal is particularly gratifying to me, as not only is this one of the highest honours of the Royal Society, but my calorimeter work has been on lines which would have appealed to Rumford, who was a pioneer in exact experiments on heat.

I hope I may be permitted to agree with you in the importance of selecting men of scientific ability to fill the position of Gas Referees, and I should like to add that common-sense and a sense of proportion are equally important.

C. V. BOYS.

The Gas Referees,
66, Victoria Street,
London, S.W. 1.
Nov. 25, 1924.

BOARD OF TRADE GAS UNDERTAKINGS RETURN FOR 1923.

PART II.—FINANCE AND PRICES.

INTIMATION was made in last week's "JOURNAL" of the fact that there had been issued the second part of the Return relating to all Authorized Gas Undertakings in Great Britain for the year 1923. This gives statistics in connection with finance and prices; while Part I. (reviewed in our issue dated Sept. 10 last) dealt with manufacture and supply. Part II. is obtainable from H.M. Stationery Office (Adastral House, Kingsway, London, W.C. 2, and Branches), at the price of 10s. 6d. net, postage extra.

There are 785 companies and local authorities included on the present occasion. This is five less than were dealt with in Part I., the five undertakings of the Stoke-on-Trent Corporation having been amalgamated into one, and the undertaking of the Montgomery Corporation having been excluded as not being carried on under statutory powers. This time the companies, at 475, number six less than a year ago, and the local authorities, at 310, are also six less than in the 1922-23 return.

Except where otherwise indicated, the particulars as to prices charged are at Dec. 31, 1923, for English and Welsh undertakings, and May 15, 1923, for Scottish concerns. The other information given in the return relates (unless otherwise noted) to the calendar year 1923 in the case of companies, and for the local authorities to the year ended March 31, 1924, for England and Wales, and the year ended May 15, 1923, for undertakings in Scotland.

The total nominal capital invested in the undertakings dealt with in the return is £165,210,254, including loans borrowed by local authorities and since repaid. This is an increase of £2,281,229 over the amount shown in the previous return. The receipts of the undertakings on revenue account, which amounted to £67,576,358, show a decline of £3,050,293 when compared with the previous year; and the expenditure, at £56,593,900, is less by £2,605,535. Thus the gross profit is decreased by £444,758.

Comparative tables in the return, which are reproduced below, set out separately the financial results for the companies' undertakings and those belonging to local authorities for the whole of Great Britain; in the former case for the years 1920 to 1923, and in the latter for the financial years 1920-21 to 1923-24.

In the case of the companies, the figures in the body of the return for 1923 are further split-up as follows:

England and Wales.—Total capital authorized, £100,063,943; capital and premiums paid-up, £84,302,791; loan capital authorized, £33,833,871; loan capital issued, £21,957,941; revenue account receipts, £44,091,469; expenditure, £37,728,146; profit, £6,364,366; loss, £1043.

Scotland.—Total capital authorized, £310,656; capital paid-up, £259,058; loan capital authorized, £123,491; loan capital issued, £77,970; revenue account receipts, £135,328; expenditure, £111,053; profit, £24,275.

The corresponding figures in the return for the local authorities for 1923-24 are divided-up thus:

England and Wales.—Total amount of loans authorized, £49,783,158; money borrowed, £45,162,601; loans repaid and balance left in sinking fund, £24,251,341; revenue receipts, £18,256,159; expenditure, £14,980,764; gross profit, £3,275,395; interest paid on loans, loans repaid, and amounts paid to sinking fund during the year, £2,259,116; net profit £1,016,279.

Scotland.—Total amount of loans authorized, £15,750,011; money borrowed, £13,449,893; loans repaid and balance in sinking fund, £5,775,758; revenue account receipts, £5,093,402; expenditure, £3,773,937; gross profit, £1,319,465; interest paid on loans, amount of loans repaid, and amount placed to sinking fund during the year, £706,179; net profit, £613,286.

In addition to the columns shown in the tables reproduced, the return gives information as to the Special Acts of Parliament and Orders relating to each undertaking, as well as the maximum or standard price of gas per therm, or per 1000 c.ft., as the case may be, and the actual prices charged to pre-payment consumers, to ordinary consumers, for power, &c., and for public lamps. There is also a column showing the scale of annual charges for meter rent to private consumers.

Glancing over the return, it would appear that the therm basis of charge had, at the date to which it was made up, been adopted by just under 500 of the undertakings, out of the total number of 785 statutory concerns. Of the 475 companies included in the return about 395 English ones, and four in Scotland, appear as having adopted the therm system by the end of the period under review. Of the 310 local authorities, by the close of the financial period 1923-24, about 93 in England, and one in Scotland, had adopted the therm.

COMPARATIVE TABLES.

Companies' Undertakings.

Year.	Number of Authorized Undertakings included in Return.	Total Capital (Share and Stock).		Total Loan Capital, including Debenture Stock.		Revenue Account.		
		Authorized.	Paid-up.	Authorized.	Issued.	Receipts.	Expenditure.	Profit.
		£	£	£	£	£	£	£
1920 . . .	494	98,469,716	82,065,243	29,109,279	18,418,665	53,714,841	49,566,608	4,148,233
1921 . . .	488	99,422,967	83,063,256	32,357,024	21,104,283	51,870,058	47,588,176	4,281,882
1922 . . .	481	100,437,430	83,793,973	33,751,958	22,011,223	46,541,952	39,785,069	6,756,883
1923 . . .	475	100,374,599	84,561,849	33,957,362	22,035,911	44,226,797	37,839,199	6,387,598

Local Authorities' Undertakings.

Year.	Number of Authorized Undertakings included in Return.	Total Amount of Loans Authorized.	Total Amount of Money Borrowed.	Total Amount of Loans Repaid, and Balance in Sinking Fund.	Revenue Account.			Interest paid on Loans, Amount of Loans Repaid, and Amount placed to Sinking Fund during Year.	Net Profit or *Deficit.*
					Receipts.	Expenditure.	Gross Profit.		
		£	£	£	£	£	£	£	£
1920–21 .	304	52,823,504	48,916,008	25,076,806	27,244,570	24,535,685	2,708,885	2,269,573	439,312 profit
1921–22 .	309	60,767,887	53,770,157	26,725,430	26,569,144	25,061,731	1,507,413	2,610,228	*1,102,815 deficit*
1922–23 .	316	64,519,579	57,123,829	28,616,471	24,084,699	19,414,366	4,670,333	2,901,500	1,768,833 profit
1923–24 .	310	65,533,169	58,612,494	30,027,099	23,349,561	18,754,701	4,594,860	2,965,295	1,629,565 profit

BRICKLAYERS AND MASONS IN THE GAS INDUSTRY.

An Agreement.

It is satisfactory to learn that after protracted negotiations an agreement, between the Federation of Gas Employers and the Amalgamated Union of Building Trade Workers, in connection with the above craftsmen was signed on the 13th ult. It appears that the Federation refused to sign the Agreement unless and until they were satisfied that the extra rate paid for retort-setting work by members of Section I. of the Society of British Gas Industries would not exceed that paid by members of the Federation of Gas Employers. Fortunately, this object has been achieved; and, on the date mentioned, an agreement was reached between Section I. of the Society and the Amalgamated Union of Building Trade Workers continuing the present Manchester Agreement (which prescribes 1d. per hour as the extra allowance for retort-setting work) until May 1, 1926, the date on which the Federation or Union are entitled to give notice terminating their agreement.

The agreement sets forth that the craftsmen concerned, whether regular or casual workers, shall not be required to lose any time owing to weather conditions, but shall be found alternative employment at their own rate in the event of outside working being impracticable. The rate of wages payable by the members of the Federation shall be the standard rate ruling for bricklayers in the district. This is to cover all work, constructional or reconstructional, maintenance or repair work; but the following allow-

ances are payable: 1d. per hour for construction, reconstruction, maintenance, and repair of all firebrick work on retorts, retort furnaces, oil-gas generators, and boiler settings; and for detached chimney work (height money), above 40 ft. and up to 90 ft., 1d. per hour; above 90 ft. and up to 150 ft., 2d. per hour; and over 150 ft., 3d per hour. As to overtime, time-and-a-quarter is to be paid for the first two hours, and time-and-a-half for the next following two hours. Overtime beyond four hours per day is to be paid for in accordance with the standard conditions ruling in the building trade in the district. Each day is to stand by itself, subject to 47 hours having been worked that week. A general permit is granted by the Union to work overtime in connection with emergency work, breakdowns, or any maintenance work which cannot be done during the normal working day; and as to new or reconstruction work, the Union agree to grant permits to work overtime in all reasonably necessary circumstances upon application for such permit being made to the divisional office of the Union. Night gangs are to be composed of separate men from those at work during the day; and 3d. per hour above ordinary rate is to be paid for such work. Procedure for the settlement of disputes is also prescribed. The agreement does not apply to the gas undertakings covered by the agreement made in June, 1922, between the Scottish District Committee of the Federation of Gas Employers and the Glasgow District Committee of the Amalgamated Union of Building Trade Workers, nor does it affect the agreement made on July 20, 1923, between the Liverpool, Birkenhead, and Wirral Districts Building and Allied Trades Employers' Association and the National Federation of Building Trades Operatives.

One point should be noted. The "extra" 1d. per hour for retort-setting work and the height money (detached chimney work) carry overtime when this is being worked.

There is also a matter which has been agreed upon by the Federation which does not appear in the actual agreement—viz., where bricklayers and masons in the regular employ of an undertaking have in the past received annual holidays, they will continue to receive them. Also where such craftsmen have enjoyed other concessions such as free gas, coal, or coke, or at cost price, or pensions or superannuation, these concessions will not be withdrawn.

The agreement is in force from the 1st inst.

MAINS AND SERVICE PIPES IN HIGHWAYS.

Right to Break-up Roads.

The National Gas Council again call attention to the attitude of highway authorities, and particularly County Councils, with regard to the rights of statutory undertakings in connection with the above subject. County Councils are endeavouring to deprive undertakings of their statutory rights in connection with the laying of mains and cables and reinstatement of highways, and to impose upon them conditions which are not only onerous, but *ultra vires*. They are also opposing Private Bills and Special Orders for the purpose of obtaining the insertion of protective clauses in their favour, which are likewise onerous, and which, if opposed, would not be conceded by the Select Committees of the Houses of Parliament or by the Board of Trade.

Gas undertakings are therefore enjoined:

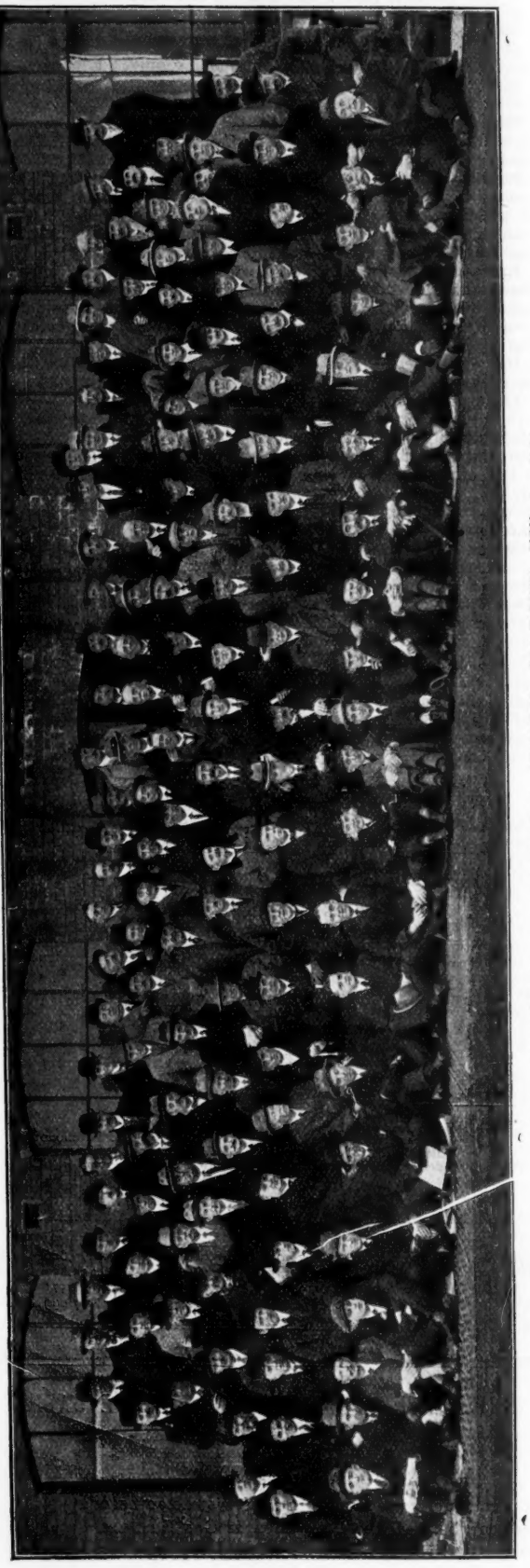
(*a*) Not to agree to the insertion of any protective clauses in favour of highway authorities without first notifying the National Gas Council, as by the insertion of such clauses precedents are being multiplied against the gas industry which will undoubtedly hamper its development in the future.

(*b*) Not to accede to any conditions which highway authorities may endeavour to impose upon them by means of an "agreement" without first consulting the Council.

Many instances have come to the notice of the Council where undertakings find themselves bound by "agreements" or protective clauses on behalf of county councils or other highway authorities which they have conceded in the past, and which are to-day proving very onerous and harassing.

Eickworth Rotary Gas Burner.

Burners for burning coke-oven or blast-furnace gas under boilers, hot-blast stoves, &c., are usually dependent on chimney pull, and take—automatically, at any rate—no account of the variable pressure of the gas, though this has the same undesirable action on the industrial burner as the variable draught of the chimney. Herr Eickworth has evolved a burner in which he transforms the pressure energy of the gas into work, by causing the gas to drive a turbine wheel which in turn drives a fan fixed on the same spindle; and this fan draws the whole of the air required for combustion into the combustion chamber without the aid of chimney draught. Any increase or decrease of the gas pressure increases or decreases the speed of the turbine, and thereby causes the fan to take in a greater or smaller quantity of air. The proportions of gas and air therefore must always remain the same. The gas is mechanically mixed with the primary air, and enters into contact, at the right distance from the burner, with the secondary air while still under the whirling effect of the burner. The result is an accelerated combustion.



AT THE OPENING OF THE MORRISTON (SWANSEA) GAS-WORKS.—NOV. 19, 1924.

THE INFLUENCE OF INERTS IN THE PRACTICAL USES OF GAS.

A German Study.

A paper on this subject, read at the Annual Meeting of the German Gas Association, was reprinted in "Das Gas- und Wasserfach" for Oct. 11. In his introduction, Dr. W. Bertelsmann, of Berlin, pointed out why the question of inerts is at present assuming so much importance in Germany. Before the war, gas supplied had been either straight coal gas, or a mixture with carburetted water gas. The gross calorific value had been between 550 and 675 B.Th.U., and inerts rarely in excess of 5 p.ct. But the war and post-war coal shortage had compelled undertakings, if they were to supply gas at all, to resort to all kinds of expedients. Blue water gas, producer gas, oven waste gases, and the products of the distillation of brown coal, peat, and wood were all used at one time or another to eke out the coal gas, so that the effect on quality can be imagined. Even in one area of supply the inerts might vary from 10 to 20 p.ct.

With the present beginning of a return to better coal supplies, it is a question as to how far pre-war qualities should be aimed at. For it has naturally been found, with suitable adjustments in consumers' apparatus, that, in many ways, the supply of poorer gas permits of a more economical use being made of the available heat units of the coal. This, in the author's opinion, is a discovery of the utmost importance to Germany, since a return to pre-war coal supplies, at any rate as far as quality is concerned, is a very distant prospect. The supply of rich gas being, therefore, neither possible nor desirable, it remains to decide to what extent, and by what means, coal gas can best be diluted, having always in mind the interests of the consumer. The authors' experience is that complaints come in no matter what gas is supplied, but that they are most numerous when quality varies. He therefore considers it of the utmost importance, when experimenting, to maintain calorific values at as steady a level as possible, and to counteract changes in specific gravity by alterations in apparatus or pressure.

From the purely theoretical point of view, it might at first sight be assumed that the efficiency of a gas, under otherwise equal conditions, would be reduced in proportion to the inerts it contained, since these are, so to speak, mere "ballast," for the heating of which a certain proportion of the combustion heat of the gas is required. But only a short while ago Berenyi, addressing the German Society of Illuminating Engineers, showed, by theoretical calculation, that the addition of nitrogen reduces the efficiency of a gas in a proportion considerably greater than the reduction in the calorific value. If, with equal quantities of heat per unit of time, the calorific value is reduced, by addition of nitrogen, in the proportion 1·2 : 1, then theoretically the efficiency is lowered as 1·5 : 1. Berenyi also estimated that the effect, in this respect, of carbon dioxide was, to that of nitrogen, as 1·6 : 1. The author's findings in the past have been very generally in agreement with these; but he is not satisfied that theory is sufficient. In practice, in all combustion, there are unavoidable losses to be reckoned with, which are apt to make theoretical calculations more or less worthless.

Reference is then made at some length to an article on "Gas Quality and Lighting Efficiency," by Terres and Straube, which appeared in "Das Gas- und Wasserfach," p. 309, 1921, and in which they made tests on upright and inverted burners with gas mixtures containing up to 43 p.ct. of inerts. But the tests on which the present article is based were, in the author's opinion, of more value in judging the practical effects of inerts on the everyday domestic gas consumption. They were made in the Tegeler Experimental Works. The first tests were with coal gas with an admixture of oven waste gases. A Graetzin burner was used. At first the gas consumption was fixed throughout at 100 litres [3·5315 c.ft.] per hour, and the primary air adjusted. With the mixtures a second series of tests was made, in which the heat units per hour were maintained in each case at about the same rate as with the corresponding coal gas. The results are shown in Tables I. and II.; the mixed gases being designated *1a*, *2a*, *3a*, and *4a*, corresponding with the straight coal gases 1, 2, 3, and 4. In the first part of Table I., the straight gases are arranged in rising order of calorific values, and it is seen, by comparing the heat units required to produce a certain candle-power (last column), that the minor variations in inerts (column 6) are without importance, but that the heat consumption for equal effect increases with rising calorific value. This would appear to confirm the contention that heat economy is, in otherwise equal circumstances, greater with poor than with rich gases. In the second part of the table, also, the mixtures are arranged according to rising calorific values, but the above rule is recognizable only in the case of *3a* and *4a*, since obviously, with the other two, the flame volume became too small owing to the extremely low calorific value. In Table II., with the heat units supplied per hour maintained as nearly constant as possible, the case is clearer still. The heat consumption to produce an equal effect rises uninterruptedly throughout, or, in other words, the efficiency is lowered with increasing quantities of inerts. Therefore, with equal supplies of heat per hour, the efficient using-up of the heat is impaired by the inert gases. But in practice, regulation is not made according to the supply of heat units; and besides, the comparison did not hold good with other diluents; and finally, the calorific values of the gases were so varied that, possibly, their effect was out of proportion.

[We have not considered it necessary to convert the German measures in the tables into their English equivalents. The following are the factors for those which are used:

For calorific value—
1 calorie = 3·968 B.Th.U.
1 calorie per cub.m. = 0·1124 B.Th.U. per c.ft.

For candle-power—
1 Hefnerkerze (HK.) = 0·915 candle-power.

For boiling tests—
1 kilogramme (kg.) = 2·2046 lbs.

For gas consumption—
100 litres (l.) = 3·5315 c.ft.

N.T.P. = 0° C. and 760 mm.]

TABLE I.—*Illumination with Graetzin Burner per 100 l. Gas Consumption per Hour.*

No.	Calories per Cub.M.		Percentage of.			Illumination HK.	Heat Consumption per Hour in Calories (net).	
	Gross.	Net.	CO_2.	N_2.	Total.		Total.	per 100 HK.
Straight Coal Gas.								
1	5354	4787	2·7	1·4	4·1	120·2	430	358
2	5568	4982	2·6	1·2	3·8	123·3	447	362
3	5880	5321	3·1	1·2	4·3	126·1	479	380
4	6056	5463	3·6	1·7	5·3	126·0	491	389
Coal Gas and Oven Waste Gas.								
2a	4207	3816	5·4	21 6	27·0	43·2	341	791
1a	4479	4013	3·8	14·6	18·4	62·1	362	583
3a	5330	4825	3·4	8·9	12·3	113·6	432	380
4a	5652	5115	3·8	6·0	9·8	119 0	462	388

TABLE II.—*Illumination with Graetzin Burner with Constant Heat Units per Unit of Time.*

No.	Calories per Cub.M.		$CO_2 + N_2$.	Hourly Consumption.		Illumination.	Calories per Hour.	Gas No. 1 = 100.
	Gross.	Net.	P.Ct.	Gas (Litres).	Calories.	HK.	Per 100 HK.	
1	5354	4787	4·1	100	430	120·2	358	100·0
2	5568	4982	3·8	100	447	123·3	362	101·1
3	5880	5321	4·3	100	479	126·1	380	106·1
4	6056	5463	5·3	100	491	126 1	389	108·6
4a	5652	5115	9·8	108	501	127·5	392	109·3
3a	5330	4825	12·3	115	495	126·3	392	109·3
1a	4479	4013	18·4	121	438	110·6	396	110·5
2a	4207	3816	27·0	135	460	108·8	423	118·1

On the basis of these experiments, another series was carried out, in which various coal gases were diluted with poorer gases so as to bring them out to about the same calorific value—viz., about 4100 calories per cub.m. gross. This time an upright incandescent burner was used, but, instead of adjusting either the gas consumption or the heat-unit consumption to an equal quantity per unit of time, practical conditions were aimed at by regulating the air so as to give the highest possible illumination. The results, set out in Table III., present quite a different picture.

TABLE III.—*Illumination of Upright Burner Adjusted to Maximum Candle-Power.*

Coal Gas Mixed with—	Calories per Cub.M.		$CO_2 + N_2$ P.Ct.	Hourly Consumption of Gas (l.).	Illumination. HK.	Per 100 HK. per Hour.	
	Gross.	Net.				Gas (l.) at N.T.P.	Calories.
Hydrogen . .	4078	3591	2·3	99	43·1	206	739
Oven waste gas	4141	3693	19·7	84	37·6	200	738
	4013	3576	19·1	90	40·4	205	734
Mean . . .	4077	3634	19·4	87	39·0	202·5	736
Nitrogen. . .	4114	3696	23·7	91	38·8	210	776
Oven waste gas and water gas	4114	3702	15·9	107	47·4	205	760
	4078	3647	17·2	108	45·8	209	763
Mean . . .	4096	3675	16·55	107·5	46·6	207	761·5

Thus, mixtures with waste gases containing 19 to 20 p.ct. behaved in much the same way as the hydrogen mixture with practically no nitrogen in it. The efficiency of a gas with 23·7 p.ct. N_2 was about 5 p.ct. less, and mixtures with waste gas and water gas showed about 3 p.ct. lower efficiency than the hydrogen mixture. This confirms the chief finding of Terres and Straube, according to which the flame temperatures of all gases equal in calorific value may be regarded as equal, and differences in illuminating effect may be attributed to variations in flame volume. If incandescent fittings are adjusted to suit flame volumes, then, under otherwise equal conditions, the influence of incombustible con-

stituents is so small that no account need be taken of them in gas manufacture.

Owing to the difficulty of finding a suitable cooker burner, the first water-heating experiments were carried out, using the same gases as in Tables I. and II., with a good bunsen burner, having gas and air adjustments. The gas supply was so regulated that the burner delivered about 500 calories per hour. In each case, after careful air regulation, the burner was so fixed as to be directly under the middle of the vessel containing water, and so that the green inner cone of the flame was 5 mm. from the bottom. The water, 3 kg. in weight, was heated from about 20° to 70° C. —*i.e.*, only through 50° C., which accounts for the relatively high efficiency shown. The results again showed that, under the conditions of the test, the inerts had no obvious influence, the values of $CO_2 + N_2$ having no regular relation to efficiencies, regarded as heat consumption required to heat a given quantity of water from 20° to 70° C. But once again efficiencies rose with regularity as calorific values fell, with only one exception, which the author attributes to probable experimental error. But it was recognized that no definite conclusions with regard to the influence of inerts could fairly be drawn from these experiments; the variation in calorific values being so considerable as to obscure the picture.

For this reason, another series was undertaken some months later, in which greater uniformity of calorific values was aimed at, with varying amount of inerts. On this occasion, the Clasen burner was available, which, owing to its non-sensitiveness towards considerable variations in gas quality, in addition to its being a proper cooker burner, was considered to be a good substitute for the previous bunsen burner. It was specially fitted with a variable nipple, to contend with the wide variations in the specific gravity of the gases used. Distances between inner cone and vessel were carefully maintained constant throughout, but on this occasion the water was heated to 95° C., instead of only 70° C. Gas consumption was so regulated as to produce 900 calories per hour, with a variation not exceeding 4 p.ct. Three mixtures were tested with each diluent, as shown in Table IV.

TABLE IV.—*Water-Heating Tests with Various Gas Mixtures. Mean Heat Consumption 900 Calories per Hour.*

Coal Gas Mixed with—	Calories per Cub.M.		$CO_2 + N_2$ P.Ct.	1 Kg. H_2O Raised 75° C.		Efficiency. P.Ct.
	Gross.	Net.		Gas (l.) at N.T.P.	Calories.	
Hydrogen	4339	3796	2·5	25·83	98·0	76·50
	4141	3643	2·3	25·90	94·4	79·49
	4093	3605	2·3	26·57	95·8	78·29
Mean	4191	3681	2·37	26·10	96·07	78·09
Waste gas	4016	3568	23·0	27·93	99·1	75·68
	4013	3576	19·1	27·48	98·3	76·31
	3946	3499	23·9	28·50	99·8	75·15
Mean	3992	3548	22·0	27·97	99·1	75·71
Nitrogen	4274	3805	20·6	26·69	101·6	73·84
	4210	3778	19·0	25·80	97·5	76·96
	4043	3634	22·8	26·98	98·0	76·50
Mean	4176	3739	20·8	26·49	99·0	75·76
Waste gas and water gas	4114	3702	19·7	26·42	97·8	76·68
	4073	3647	17·2	26·67	97·3	77·11
	4010	3615	21·0	26·97	97·5	76·94
Mean	4067	3655	19·3	26·69	97·53	76·91

The greatest variation of any one from the mean calorific value of these gases is 5·65 p.ct., and differences in specific gravity were counteracted by varying the supply in a unit of time. Therefore the quantity of inerts present in each case constituted the sole important difference between them. The effect of this is clearly shown in the table. The gases diluted with hydrogen, which contained 2·3 to 2·5 p.ct. of $CO_2 + N_2$, required only 94·4 to 98 calories to raise 1 kg. of water 75° C. The other nine, with 17·2 to 23·9 p.ct. of inerts, required 97·3 to 101·6 calories, thus confirming the theory that the economy of heat consumption is impaired by the presence of large quantities of inerts, other conditions being equal. But the difference is only small; only 1·5 to 3 p.ct. more being required of gases with 19 to 22 p.ct. of inerts than of those with 2·5 p.ct. This naturally raises the question whether such small differences are worth taking into consideration in practice, in comparison with the effect of unavoidable variations which are bound to occur in the calorific value of the gas, not to mention losses due to incorrect burner regulation, and to radiation and convection.

The effect of variations in calorific value is shown in Table V. The tests were carried out under the same conditions as the cooker experiment described above. At first it is seen again that the lowering of the calorific value influences the heating efficiency favourably, for all the diluted gases give a better result than the pure coal gas. But the greatest variation in the efficiencies of the seven mixed gases is only 1·15 p.ct., without any definite influence of the diluents being obvious. Gases with 20 p.ct. and 30 p.ct. of $CO_2 + N_2$ give practically the same efficiencies, because the adverse effect of the increased quantities of inerts is counteracted by the favourable effect of the lowered calorific value.

TABLE V.—*Water-Heating Tests with Gases of Varying Calorific Value.*

Mean heat generated per hour, 900 calories.

No.	Coal Gas.	Calories per Cub.M.		$CO_2 + N_2$ P.Ct.	1 Kg. of Water Raised 75° C.		Efficiency P.Ct.
		Gross.	Net.		Gas (l.) at N.T.P.	Calories.	
1	Undiluted.	5127	4553	1·2	22·00	100·2	74·85
2		5091	4534	1·2	22·40	101·6	73·82
3		5090	4519	1·0	22·40	101·2	74·12
	Mixed with:						
2	20 p.ct. of hydrogen	4603	4076	1·0	24·27	98·8	75·91
1	10 ,, of waste gas	4555	4047	11·1	24·33	98·4	76·22
3	10 ,, ,, ,,	4497	3977	11·1	24·70	98·3	76 30
2	40 ,, of hydrogen	4256	3737	0·7	26·57	99·3,	75·53
1	20 ,, of waste gas	4016	3568	21·0	27·93	99·1	75·68
3	20 ,, ,, ,,	3946	3499	20·8	28·50	99·8	75·15
1	30 ,, ,, ,,	3547	3143	30·8	31·53	99·1	65·68

The behaviour of inerts in the water-heating tests may, in the author's opinion, be taken as typical of their effect on other gas apparatus which is required to generate heat of lower ranges of temperature. To test their effect at higher temperatures, he used a small gas forge with compressed air, consuming approximately 1 cub.m. [35·31 c.ft.] of gas per hour, fitted with a small piece of magnesia, temperatures being taken with a Féry pyrometer. The best method was found to be to choose a fixed temperature —for instance, 1400° C., the approximate point required for welding—and to find how much of each gas was required to maintain this. The furnace was, in each case, heated up to this temperature, and kept there for an hour before introducing the test gas. Then necessary adjustments for gas and air were made, and the temperature maintained constant for at least half-an-hour. Combustion was watched during the whole operation by means of analyses of the waste gases, and so regulated that they contained 0·5 p.ct. of free oxygen; it having been found that this gave the maximum temperature.

TABLE VI.—*Gas-Forge Working with Various Gas Mixtures at 1388° to 1390° C.*

Coal Gas Mixed with—	Calories per Cub. M.		$CO_2 + N_2$. P.Ct.	Hourly Consumption.	
	Gross.	Net.		Gas (l) at N.T.P.	Calories.
Hydrogen	4421	3886	2·3	835	3377
	4339	3796	2·5	914	3469
Mean	4380	3841	2·4	900	3453
Waste gas	4013	3576	19·1	967	3458
Waste gas and Water gas	4114	3702	15·9	935	3460
	4078	3647	17·2	951	3469
Mean	4096	3675	16·55	943	3465

From the results in Table VI. no connection can be traced between the inerts and the heat units required to maintain the given temperature; the variations in the latter being all within 1 p.ct., or the limits of experimental error. Unfortunately the gases diluted with hydrogen fell out rather high in calorific value, for possibly in this case also, as with the boiling tests, the efficiency may rise with falling calorific values, so that the comparison may not be an entirely true one. But the two gases differ in net calorific value by 90 calories per cub.m., and the heat consumption differs by 32 calories; on the other hand, the respective figures for the second hydrogen-diluted sample and the first waste and water gas sample are 94 and 9. From this it might almost be assumed that, within the given limits, temperatures are not influenced by the inerts, thus again confirming the findings of Terres and Straube as to equal flame temperatures. But in any case the fact should not be lost sight of that, at these higher temperatures, losses by radiation and convection possibly obscure whatever effect the inerts may have.

In summing up, Dr. Bertelsmann considers that the results of his experiments, as far as lighting and cooking are concerned, confirm what theory teaches, namely, that the incombustible constituents of gas act as a heat-consuming ballast. But in his opinion they do not confirm previous beliefs, based on this theory, that the industry should necessarily be warned against diluting gas with inerts. The harmful effect of such dilution in the practical applications of gas as a fuel is so slight as to be negligible in comparison with the results of unavoidable variations in pressure and in quality. It would not, in his opinion, be advisable to urge any restrictions on those works which have no plant available for diluting with water gas. Much more important is it for the industry to aim at uniformity of calorific value, so that makers can supply apparatus which will give the best service anywhere; it being easy to deal with variations in specific gravity. Experience has shown that a gross calorific value of 4200 to 4300 calories per cub.m. [472 to 483 B.Th.U. per c.ft.] is sufficient for all purposes of gas supply.

A JET CALORIMETER.

By W. PAYMAN.

[Reprinted from the November issue of "Fuel in Science and Practice," by kind permission of Prof. R. V. Wheeler, Joint Editor.]

The size of the inner cone of flame burning at the mouth of a bunsen burner is dependent upon the initial speed of propagation of flame in an aerated mixture supplied through the bunsen tube. The size of the envelope of flame round the inner cone is presumably dependent on the amount of air required by the products of incomplete combustion in the inner cone for their complete combustion. Similarly it appeared safe to predict that the height of the flame produced at a jet without primary aeration is dependent upon the amount of air required for the complete combustion of the particular gas used. It is known that the calorific value of a gas is proportional to the amount of air it requires for its complete combustion. Experiments to investigate this assumption were carried out, and the heights of the flame were plotted against the calorific values of the gases used. With certain limits the curve was a straight line; and the results proved that the size of the flame produced at a jet by a non-aerated gas is directly proportional to the volume of air required for the complete combustion of that gas, and therefore to its calorific value, provided that the gas does not contain more than a limiting proportion (probably a third of its volume) of hydrogen. The following is a description of a cheap and simple apparatus for the measurement of flame, which will form an extremely useful appliance for use in gas-works for the works control of calorific value.

The general replacement of the old flat flame by the bunsen burner for both heating and lighting, and the adoption of the therm system of charging for coal gas and town gas, have rendered the old determinations of illuminating value useless from a practical point of view. As a result, the old jet photometer has lost the place it once held as the sole means of keeping under approximate control the make of gas in the works itself without having recourse to the accurate but more tedious determination in the laboratory. The need is evident for a device to take the place of the old jet photometer, an instrument which, by virtue of its simplicity and convenience, served very satisfactorily the purpose for which it was designed. Several instruments for this purpose have been described, each having as its basic idea the determination of calorific value, with the help of a more or less aerated bunsen flame, instead of the illuminating value by means of the old jet flame.

The "Gasprüfer" of M. Hofsäss consists of an enclosed bunsen burner and scale, the quality of the gas being determined by the height of the inner cone of the bunsen flame (J. für Gasbeleuchtung, Sept. 20, 1919). The gas supply is controlled by means of an inclined manometer. In the Brady indicator (see "JOURNAL" for Dec. 16, 1912, p. 608), a bunsen burner is used, and the proportion of gas and air supplied is adjusted until a yellow tip appears (or disappears) in the inner cone. The ratio of gas to air at this point is found to be proportional to the calorific value of the gas, with a large range of gas mixtures. One of the disadvantages of the Brady indicator is that it is intermittent. A modification which is continuous, and known as the "Caloriscope," has been described by E. V. Evans (see "JOURNAL" for Dec. 1, 1920, p. 511). In the "G.V." or Grebel-Velter indicator (see "JOURNAL" for Aug. 9, 1922, p. 322) the principles of the Hofsäss and Brady instruments are combined; the two burners being used simultaneously.

Though these instruments are very ingenious, none can be said to approach the old jet photometer in simplicity and ease of manipulation. The following description of a "jet calorimeter" may therefore be of interest to the gas industry; the instrument being cheaply constructed, simple in manipulation, direct reading, and requiring little or no experience in use once it has been assembled.

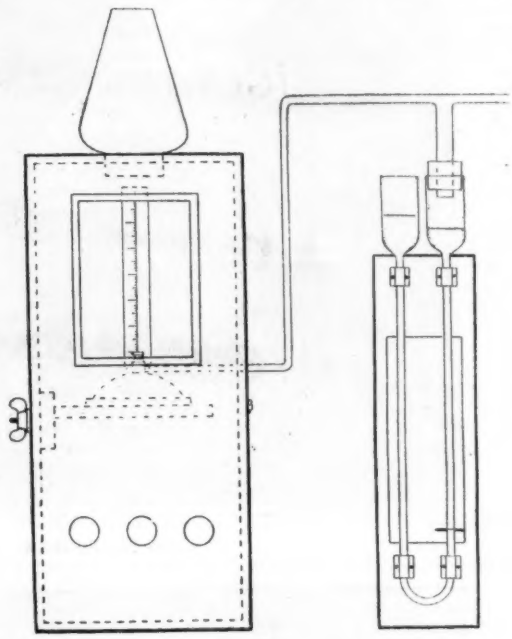
The jet calorimeter consists of two parts, the observation chamber, containing the burner and scale, and a differential manometer. The apparatus used in the laboratory will be described, but only the size of jet and gas pressure need be kept exactly as described. The observation chamber may be of any convenient size, and the differential manometer replaced by any other device for maintaining accurately the gas pressure at the required value.

The observation chamber consists of a wooden box 18 in. high, 8 in. wide, and 6 in. deep. The front of the box is hinged, and is fitted with a glass window about 6 in. by 4 in. In the laboratory apparatus, this consisted of a photographic half-plate with the emulsion removed. The top of the box is fitted with a cheap lamp glass, and the front and sides are furnished with air holes near the bottom. The scale seen through the window in the diagram was fixed to the back of the box and consisted of a strip of glass silvered on the back and etched (in tenths of an inch in the laboratory apparatus) on the front. The mirror renders it easy to read off the height of the flame without introducing errors due to parallax. One-half of the scale was covered with black paper—an arrangement which was found to be helpful when it was desired to examine the appearance of the flames in addition to their heights. The glass scale may be conveniently replaced by one of polished metal, on which the scale could be scratched.

The burner, which stands on an adjustable shelf as shown, consists of the base of an ordinary laboratory bunsen burner. This is fitted with the nozzle, which consists of a brass jet (No. 4) as supplied with the Oldham gas testing chamber, this having a circular orifice 44 thousandths of an inch in diameter.

The differential manometer is of the usual type, except that it need not be graduated. If it is not possible to check the calorific value of the gas supplied when the apparatus is first set up, this manometer should be calibrated to read ½ in. water pressure. The tubes should be filled with coloured methylated spirits and a good white paraffin respectively; the limb exposed to the air being closed with a loose wad of cotton wool. Evaporation can be allowed for by adding more liquid if the zero of the apparatus is marked when no gas is flowing, both limbs being open to the air. Since only one graduation is needed, the manometer could be constructed cheaply; the accurately dimensioned tubes usually required for its construction being unnecessary. If desired, the differential manometer may be replaced by an inclined manometer (see Lunge, "Gas Analysis," p. 189); but the former was found more satisfactory.

The general arrangement of the apparatus is evident from the diagram. Connections should be of metal or glass tubing, but



A Jet Calorimeter.

thick-walled rubber "pressure" tubing and a glass T-piece connection to the manometer have been found satisfactory. The gas inlet should be supplied with a control tap. The scale may be graduated in tenths of an inch, or more conveniently the graduations may be made to read calorific value directly. For this purpose a graduation should be marked 2·95 in. from the zero to represent 300 B.Th.U. per c.ft., and a second 6·80 in. away to represent 1000 B.Th.U. per c.ft. The space between the 300 and 1000 marks is then divided into 35 equal divisions each representing 20 B.Th.U. It will be found easy to read such a scale to within 10 B.Th.U. per c.ft.

The upper surface of the burner jet is adjusted to the level of the zero of the scale. With a calibrated manometer, the instrument is then ready for use. It is advisable, however, in any event to determine, by the usual calorimetric methods, the calorific value of the gas supplied at the time the apparatus is set up, to adjust the gas pressure until the height of the flame corresponds exactly with the calorific value of the gas used, and then to mark the manometer level; this level being used for all future determinations. To use the apparatus, it is then only necessary to turn the supply tap until the manometer shows that the pressure is exact, and the calorific value is then read off from the scale.

"A Wise Fool."—Messrs. John Long, Ltd., have forwarded a copy of "A Wise Fool," by E. C. Reed, which has been selected as the prize-winning novel from several hundred novels submitted in the John Long £500 competition for the best first novel. It is not customary for us to notice novels in our columns, but this has particular interest in that the author is an Engineering Publicist and Editor of two trade journals. He is a well-known contributor to the Technical Press, writing chiefly on matters connected with boiler-house efficiency. He has, however, not neglected the broader side of literature, having had several poems and short stories published, as well as articles and lectures on more general subjects. Mr. Reed was one of the founders and first members of the Engineers' Club, Piccadilly Circus. His new book is published at 7s. 6d. net.

THE FINSBURY GAS METER TESTING STATION.

New Office of the London County Council.

The new gas meter testing station of the London County Council, in Helmet Row, Finsbury, which was officially opened by Mr. Cyril H. M. Jacobs, Chairman of the Public Control Committee, on Nov. 7, is a timely application of modern methods to modern conditions, and provides an inspiring comparison between the state of affairs but a few years ago and those which hold to-day; it is, in fact, a practical recognition of the amazing development of the gas industry, and has been designed to cope with the requirements resulting from the ever-increasing public demand for gaseous fuel. To give some idea of the growth of the work in the Council's area, it may be mentioned that in 1864 the number of meters tested was 31,186, and the fees received amounted to £1026. In 1898 the corresponding figures were 195,752 and £6468; while during the year 1923-24 no fewer than 287,418 meters were tested, and £17,713 was the total of the fees received.

FIG. 1.—GENERAL VIEW OF THE TEST ROOM.

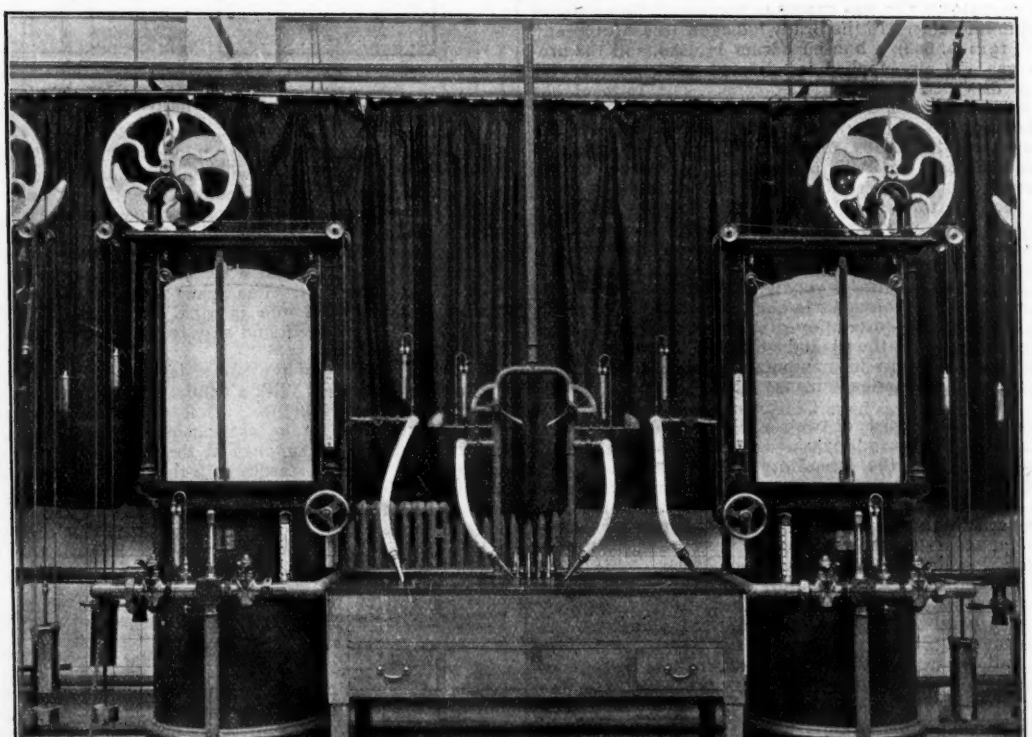


FIG. 2.—AN ILLUSTRATION OF THE CONNECTIONS, SHOWING THEIR ACCESSIBILITY.

The testing work is carried on at four offices. The old Spitalfields office, which the new office replaces, was the last of the original testing stations provided by the Metropolitan Board of Works, and had become wholly inadequate. It was in a congested district and under the shadow of the Spitalfields Market, and access to it was often difficult by reason of market traffic. The new building in Helmet Row suffers from none of these disadvantages. The site, about 7200 sq. ft. in area, formed part of a piece of land acquired by the Council for the extension of the adjoining school playground, and was transferred by arrangement to the Public Control Committee at an agreed valuation of £4000. The building, designed by the Architect to the Council, has been erected on strictly economical lines, and the planning of the premises has been arranged so as to facilitate the convenient and efficient working of the office. The appearance of the testing room, which, through the courtesy of Mr. J. Ollis, the Chief Officer of the Public Control Department, we visited a few days ago, is pleasing without being ornate. We were particularly impressed by the excellent natural lighting of the room, which is afforded by overhead and side lights. In connection with the overhead lights "Pinoleum" blinds have been provided, so that, without interfering with ventilation, on hot summer days—almost forgotten—the temperature can be nicely regulated. The resident officer's quarters and other staff accommodation have also been arranged in a most satisfactory manner—obviously the result of considerable thought. For instance, the staff cloakroom is efficiently heated, so that wet outer garments can be dried easily; and the dining-room is also very comfortable. The adjoining property in Norman's Buildings, about 1190 sq. ft. in area, was acquired nearly eighteen months ago, at a cost of £300, for the extension of the office; and when this extension is completed the station will be the largest of its kind in the kingdom. The cost of the building was £10,600.

Changed Conditions.

The old offices at Spitalfields were badly ventilated. Formerly gas was used for testing the meters; and the exuding odours from old meters, and the products of combustion were all discharged within the offices. It is easy to imagine the unhealthiness of it all. The new office forms a marked contrast. Ventilation is excellent, and the testing medium is now air; the pressure being obtained by a ½-H.P. Keith blower running at 2700 r.p.m. and capable of delivering 300 c.ft. per minute, and of raising all the bells in the office in one or two minutes. Surplus air is discharged into the room to improve ventilation. The difference in the accuracy of testing a meter by air instead of gas is infinitesimal and practically negligible, but a net saving of £500 a year has been effected by the change.

Equipment.

The station contains, in addition to the standard cubic foot bottle, two pairs of 20 c.ft. holders, twelve pairs of 10 c.ft. holders, a 100-light standard test meter, and a 20-light standard meter. Further plant will be added when the extension referred to above is completed. Part of the plant is new; some of it old. The new plant comprises five pairs of holders supplied by Messrs. W. Parkinson & Co. Of the old apparatus, some was brought from the Spitalfields office and some was transferred from the station at Clerkenwell. There are services for gas, air, and water, in the running of which 1000 ft. of iron barrel was used. In the fitting of the plant many improvements have been made by which the working of the bells is facilitated and error due to friction prevented.

Improvements.

A noteworthy advance has been made in the position of the cocks. As will be seen from the illustration, all these have been brought down to working level—a practical feature which is thoroughly appreciated by the tester. Also the 3-in. pipes connected with the 20-c.ft. holders have been fitted with 1-in. connections suitable for small work, so that with one pair of holders it is possible to test any size of meter from 1 to 1000 light. Many minor improvements in method could be mentioned. For example, soundings are done by U gauges. The pressure is thrown on the inlet gauge and is then shut-off from the holder, thereby minimizing possible error due to faulty connecting pipes. Another point of interest is that cocks graduated to pass ½ c.ft. or 1 c.ft. of air per hour are used for testing meters for non-registration. The staff do their own stamping; and the torch used for this purpose is so designed that a full supply of gas is assured when in a working position, but when the torch is out of use and in a vertical position the supply is cut down to that of a small pilot light.

The adaptation of the plant had to be worked out as the installations proceeded; and the fact that during the whole period of the change-over from one office to the other the ordinary testing work was carried out without interruption reflects great credit on Mr. G. F. J. Knott, the Senior Inspector, and his staff. To Mr. Knott our thanks are due for his courtesy in showing us over the new station, which is undoubtedly a model of efficiency.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Visit to the Glenboig Fireclay Works.

About sixty members of the Association paid a visit to the Glenboig Union Fireclay Company's Works at Glenboig on Saturday, Nov. 22. The visitors were received by Mr. Dunnachie, the Chairman and Managing Director of the Company, who, with Mr. Douglas, the Works Manager, and other members of the staff, acted as a guide for the tour of inspection.

The starting point of interest was the laboratory, where there were shown the various grades of fireclay mined by the Company, together with specimens of the manufactured material. Here one was struck with the elaborate precautions to ensure that the raw materials are up to the required standard. At the pithead, steps are taken to keep out all foreign material. The grinding mills, laid out in sets of one dry to four wet pans, prepare the clay for moulding purposes, which is then conveyed to the various machines and moulding tables.

The construction of the machines for making fireclay bricks, aiming as near as possible to the special characteristic of firebricks made by hand moulding, was explained; while an interesting demonstration was given of pressing with specially-constructed dies from the rough to the finished article. Practical demonstration of retort building was also given in the retort shop; and it came as a surprise to most to learn what great possibilities lay in a piece of clay, and how many processes it had to go through before it became suitable for its particular purpose. The retort stoves, seven in all, are well planned to cope with a very large output.

The visitors were naturally interested in the gas-fired kilns. The Glenboig Company pay particular attention to the burning of all their goods, to ensure that the contraction test comes well within the limit set out by the Institution of Gas Engineers' specification for refractory materials. The kilns are of the Dunnachie continuous type, set out in sets of ten. Their chief characteristic is that the burned-off chambers are utilized as regenerators for heating the air before it enters the combustion chambers. The waste heat is carried through the kiln in front of the burning chamber, and this kiln takes up all the residual heat in the gases, which ultimately pass to the chimney at about 350° Fahr.

All the machinery is driven by electricity. The works and buildings cover thirty acres, while the floor space for manufacturing purposes is fully fourteen acres—sufficient to manufacture several hundred thousand ordinary-sized bricks daily.

The Glenboig Company, however, manufacture a large variety of special sizes ranging in weight from a few pounds to many hundredweights, the latter occupying the drying floor for many weeks. The variety of sizes and styles was a feature noted by the visitors; among the specials being the panel bricks for the new Woodall-Duckham vertical retorts at Granton, for the Edinburgh Corporation.

There are in use at present 141 kilns burning various classes of refractory materials. Sixty-four years ago, when operations commenced at Glenboig, the output was about 3000 tons per annum. To-day it is 150,000 tons per annum; and of this, 10,000 tons represents gas retorts of all types. The district of Glenboig possesses an almost inexhaustible deposit of fireclay in strata which belong to the millstone-grit series of the Scottish coal measures. When properly selected and treated, the clay yields firebricks of extraordinary heat-resisting qualities.

At the conclusion of the inspection, the visitors were entertained to tea in the Institute Hall.

Mr. Dunnachie, who presided, expressed the pleasure his Directors had in having the Juniors at their works. With the great changes in gas-works practice of the last few years—for example, the development of vertical retorts—they were anxious to get into close touch with their customers. In this way they realized some of the difficulties, and were better prepared to solve the problems. Their kilns were now entirely fired by gas, and they had found it the most efficient fuel for the temperatures they required. He commended the work of the Association, and wished them further success.

Mr. John M'Isaac, President of the Western District, returned thanks to Mr. Dunnachie and his co-Directors for the facilities afforded the visitors. Refractory materials for gas-works construction called for strength, quality, and long life. All these were to be found at Glenboig. The Glenboig Company still held prime place among the manufacturers of refractory materials. He also thanked Mr. Douglas and his assistants for the courteous manner in which they had shown them round.

The next meeting of the Western District will be held at the Royal Technical College, Glasgow, on Saturday, Dec. 6, at 3 o'clock, when Mr. James Graham, of Kilmarnock, will read a paper on "Distribution Problems."

It has now been arranged to celebrate the majority year of the Western Juniors by holding a dinner in Glasgow on Saturday, Feb. 14, 1925. This early intimation is made so that old members may keep the date open, as it is hoped the occasion will also serve as a reunion of the members from 1904 onwards.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING IN LONDON.

A BUSY afternoon was spent by the members of the Association on Tuesday of last week, on the occasion of a general meeting in the Charing Cross Hotel. Lengthy discussions followed the reading of three papers on topical subjects, and in addition to this there was the election of new officers and members. Mr. LEONARD J. LANGFORD, of Tunbridge Wells, presided, and before the proceedings closed expressed his thanks for the support accorded him, saying that his year of office had been exceedingly happy.

CONFIRMATION OF MINUTES.

The PRESIDENT suggested, and it was agreed, that the minutes of the last meeting as published in the "GAS JOURNAL" should be taken as read and confirmed.

THE NEW PRESIDENT.

The PRESIDENT said it was now his duty to propose the President for 1925. It was an exceedingly pleasing one, as in submitting the name of his friend the Vice-President, Mr. Philip G. G. Moon, of Bournemouth, he knew members would feel with him that the Association would have as its leader one who could not be better qualified and equipped to control and advance its activities. He had spoken last year of Mr. Moon's excellent engineering and administrative qualities. They were familiar to them all, and needed no further comment on his part; but Mr. Moon possessed another quality which had particularly appealed to him, and it was one he envied—his fine command of speech. Mr. Moon addressed his audience with the ease, grace, and charm of the born orator; and he thanked him sincerely for the generous assistance he had freely given him (Mr. Langford) during his year of office. For some years Presidents had been selected alternately from east and west of the Association's wide area. This year the geographical position was practically on the centre line, which was a good omen for the strengthening of the connecting links in the happy relations existing between the Eastern and Western Sections. In proposing Mr. Moon as President of the Southern Association of Gas Engineers and Managers, he knew it would be heartily acclaimed; for Mr. Moon was jealous of its traditions, and would materially add to their lustre. His presidential year would be the jubilee year of the Association; and however they might celebrate the event, he would suggest that one item should be the rendering of a duet by the two immediate Past-Presidents, Mr. Hoyte and himself—both of proved vocal power—entitled "Dear Moon has Raised his Lamp Above." [Laughter.] He had very great pleasure in proposing Mr. Moon as their President.

Mr. R. ROBERTSON (Bristol), in seconding the proposal, remarked that he could not conceive of any one better fitted to maintain the traditions of the past, and to follow the long line of distinguished predecessors in the office, than Mr. Moon. He represented an undertaking which deservedly enjoyed the reputation of being one of the best-managed and most progressive in the country, while he himself was recognized as second to none as an engineer and an administrator.

The resolution having been carried with applause,

Mr. PHILIP G. G. MOON (Bournemouth) said he much appreciated the great honour that had been done him in electing him President of the Association. He found himself, as Mr. Robertson had remarked, in succession to a long line of distinguished men who had filled this position in the past—men distinguished in the industry, as well as by the dignity with which they had upheld the office. He realized, therefore, that the honour carried with it a responsibility peculiarly its own. The gas industry had, he ventured to suggest, never been in a more important position than it occupied at the present time. ["Hear, hear."] They found themselves on a wave of increasing activity. The output of gas and the sales of apparatus both testified to the favour with which gas was regarded by their consumers; and this naturally imposed upon them the necessity for greater industry, greater initiative, and greater efficiency. They must lose no opportunity of studying new processes for the works, and of considering improved methods both in the works and on the district. It was in these directions that the function of the Association lay; and so far as he could help in the furthering of these aims, he would be only too happy to do so. He felt that he was in an unfortunate position in starting with a reputation which he did not deserve; but it would be his endeavour not to do anything which would in any way cause him to forfeit the confidence which they had reposed in him.

THE VICE-PRESIDENT.

Mr. MOON said it was his pleasure now to propose as the Vice-President for the ensuing year Mr. R. Robertson, the Engineer to the Bristol Gas Company. He represented what was probably the largest undertaking in the west, and he had a front-rank reputation for engineering ability. Certainly he would make an excellent Vice-President, and would no doubt later on worthily succeed as President the many distinguished men to whom he had himself referred.

Mr. C. F. BOTLEY (Hastings) regarded it as a privilege to second the proposal, for he had known Mr. Robertson for many years, as well as his predecessor at Bristol, Mr. Daniel Irving. Mr. Robertson, he felt sure, would be of great assistance to the Association in the office to which, it was to be hoped, he would later on succeed.

Mr. ROBERTSON, in acknowledgment, expressed regret that he possessed very few of the qualifications of the present President or the newly-appointed one. Therefore he approached with a considerable amount of diffidence the proposition that he should take office. He would, however, do his best to merit the confidence of the members.

GENERAL COMMITTEE AND DISTRICT COMMITTEES.

The HON. SECRETARY (Mr. W. H. Bennett, of Redhill) read out the following list of elections of district officers and members of committees for 1925

Eastern District, 1925.

Chairman.—Mr. F. Smallbone.
Vice-Chairman.—Mr. J. Terrace.
Hon. Secretary.—Mr. L. Trewby.
Committee.—Messrs. A. H. Andrews, C. V. Bennett, W. H. Bennett, A. Caddick, C. Chambers, A. G. Cheal, T. Carmichael, S. Lacey, L. J. Langford, R. H. Ruthven, C. H. Rutter, A. W. Sumner, J. S. Thorman, and W. H. Warren.
Representative on the General Committee, in place of those retiring by rotation: Messrs. A. H. Andrews and W. H. Bennett.

Western District, 1925.

Chairman.—Mr. C. G. Dawson.
Vice-Chairman.—Mr. J. Hughes Cornish.
Hon. Secretary.—Mr. W. E. Dean.
Committee.—Messrs. James Armstrong, S. E. Halliwell, H. Higham, P. S. Hoyte, J. Harger Pye, H. E. Riley, James Taylor, W. P. Tervet, E. P. Vince, and J. Wesley Whimster.
Representative on General Committee in place of Mr. R. Robertson (appointed Vice-President): Mr. W. E. Dean.

HON. AUDITORS.

Proposed by Mr. T. PRICE (Walton-on-Thames), and seconded by Mr. FRANK LIVESEY (Maidstone), Messrs. James Donaldson and John Urquhart were re-elected Hon. Auditors.

MR. BENNETT'S RETIREMENT.

The PRESIDENT said they would remember that their esteemed Hon. Secretary, Mr. Bennett, was persuaded a year ago to retain office for another twelve months, on the distinct understanding that he would at the end of that period be relieved. Though anticipated, his resignation—or he (the President) preferred to call it relinquishing of office, as he would still render every assistance to the new Secretary—would be received by every member of the Association with the deepest regret. During the past five years, Mr. Bennett had worked vigorously and most successfully for the Association's welfare; and those Presidents who, like himself, had had the benefit of his able services and wise guidance, had been much impressed with his grip of every detail of the organization, and with his untiring enthusiasm in transacting the heavy duties connected with the office. He made light of these responsibilities, but they had absorbed a great deal of his valuable time. The work, though generally pleasant, was not always so. Difficulties arose; but with his wonderful tact and knowledge of human nature, he had made the rough places smooth. They all sincerely regretted that his health had been far from good during his long term of office, but were glad to know that he was physically stronger to-day than he had been for some time past. He felt he must mention a great anxiety that Mr. Bennett was bearing at present, in the very serious indisposition affecting Mrs. Bennett. They would all sympathize with him, and express the earnest hope that Mrs. Bennett's health might be speedily restored. ["Hear, hear."] Mr. Bennett remained their Secretary until the close of the year, so that their thanks would be tendered to him at the March meeting—providing, of course, he then submitted a correct and satisfactory statement of the year's accounts. [Laughter.] While they must accept his resignation, they did so with the deepest regret, and with profound appreciation of his long and devoted service to the best interests of the Association. He would now ask Mr. Bennett to propose his successor.

MR. HAROLD C. SMITH AS THE NEW SECRETARY.

Mr. BENNETT expressed his keen appreciation of the remarks made by the President regarding his services, though he feared he did not deserve them all. Anyhow, if he had failed to reach the standards he had set up for himself, it had not been for the want of trying. He had done his best to advance the Association, though there were still some things he would like to see

altered. He was particularly pleased that the Association had gained in strength. During the past five years they had added 57 members, and those down for election at the present meeting would bring the total to 307—the largest number of any Senior Association in the country. He had also to thank them for their sympathy with regard to his wife. Now as to his successor. Several gentlemen had been approached, but it was wonderful how busy gas managers were, so that they could not undertake the job. However, as usually the busiest man was the one who had the most time, he thought of Mr. Harold Smith, the Chief Engineer to the Tottenham District Light, Heat, and Power Company, and after some persuasion Mr. Smith had consented to allow his nomination. [Applause.] Everyone who knew Mr. Smith was aware that not only was he a very keen and able Engineer, but he was already very popular in the South of England, and above all he possessed a sense of humour and was a "sport." A man with a sense of humour to-day, in the trying times they were passing through, possessed a very helpful quality. He formally proposed that Mr. Harold C. Smith, of Tottenham, be elected Hon. Secretary for the coming year.

Mr. MOON seconded the proposal with considerable pleasure. He confessed that when he first heard Mr. Bennett was definitely retiring—bearing in mind the fact that he himself was in all probability to be President—he was filled with dismay, because it must be common knowledge that the man who really did the work was the Secretary, and not the President; the President getting praise usually for work he never did. However, when subsequently he learned that Mr. Smith had consented to take on the arduous duties he was relieved, and still more so when he was assured by Mr. Bennett that he would be at the right hand of Mr. Smith throughout at any rate his first year of office. He was confident that in Mr. Smith they would have a man who would emulate as far as possible the devotion to service which Mr. Bennett had displayed.

The PRESIDENT remarked that they were fortunate in that Mr. Smith was centrally situated, which was very desirable in order to secure first-hand information. [Applause.]

Mr. SMITH (who was prevented by a Board meeting from being present at the opening of the proceedings) subsequently thanked the members for electing him Secretary, and declared that it was not a job he had sought. He was sorry Mr. Bennett was retiring, because he had been a most excellent Secretary. He would do his best, and if, when he in his turn retired, he left the Association in the same position as Mr. Bennett was leaving it, he would be satisfied.

NEW MEMBERS.

The HON. SECRETARY then read the following names of new members, who were promptly elected:

Mr. Walter Alfred Barnett, New Barnet.
Mr. Frederick William Beech, Selsey.
Mr. Lawrence Walter Boulter, Gas-Works, Poplar.
Mr. James Hughes Cornish, jun., Bridgwater.
Mr. John Francis Haseldine, New Barnet.
Mr. John Nicholls Higgs, Swanage.
Mr. Alfred John Kingdon, Bude and Okehampton.
Mr. Julius Lucas, Southampton.
Mr. David Thomas Marwick, Portsmouth.
Mr. Albert Henry Mills, Portsmouth.
Mr. Frank William Stapleton, Gas-Works, Beckton.
Mr. Ralph Staley, M.C., Bishop's Stortford.
Mr. Garnet Templeman Temblett, Andover.
Mr. Harold Major Tysoe, Milton Regis, Kent.
Mr. Greville John Whatley, Palace Chambers, Westminster.
Mr. Norrie Willsmer, Harrow.

PAPERS AND DISCUSSIONS.

The next business on the agenda was the reading and discussion of the following three papers:

"Notes on Carbonizing Temperatures," by Mr. W. H. Warren, of the Gas Light and Coke Company.
"The Use of Live Steam in Purification," by Mr. F. J. Pearce, of the North Middlesex Gas Company.
"Commercializing the Distribution Department in the Service of the Public," by Mr. W. J. Sandeman, of the Croydon Gas Company.

The first of these, with the report of the discussion, follows; the others being reserved for a later issue.

THANKS.

The PRESIDENT said he desired to thank the authors of the papers heartily for having thus rallied to his support. They had all spent an exceedingly profitable afternoon.

Mr. C. VALON BENNETT (Rochester) proposed a hearty vote of thanks to the President for all he had done for the Association during his year of office.

Mr. J. HUGHES CORNISH (Bridgwater) seconded this, and it was carried by acclamation, and acknowledged by the PRESIDENT.

The members then took tea together.

Our Fuel Problem.—In the current issue of the "Review of Reviews," there is an article on "Our Fuel Problem," with special reference to the place of gas in our domestic and industrial economy. It is by Mr. F. W. Goodenough, Executive Chairman of the British Commercial Gas Association, which is a sufficient assurance that it is full of interest.

NOTES ON CARBONIZING TEMPERATURES.

By W. H. WARREN, of the Gas Light and Coke Company.

[A Paper read before the Southern Association of Gas Engineers and Managers, Nov. 25, 1924.]

Much attention has been recently directed to the extraction of the maximum gaseous thermal value from coal; and it would be superfluous to repeat the advice which has been given in various papers, the value of which cannot be too highly appraised, on details connected mainly with the avoidance of degradation and the exclusion of inerts. Less stress has been laid on the pecuniary importance of bye-products; and the modern tendency seems to sacrifice these to the "cult of the therm." It is generally accepted that a high final retort temperature is essential to the production of the maximum yield of gaseous therms. This temperature is governed by two main factors—the throughput and the temperature in the combustion chamber. It can be assured as easily with a combustion temperature of, for example, 1200° C. as with one of 1400° C. The difference between the retort temperature and the combustion temperature is sometimes known as the temperature gradient, and on it depends the rate of carbonization, or throughput.

The tendency during the past few years has been to attempt to maintain both thermal yield and throughput. Strenuous efforts have been made to increase combustion temperatures. Larger grates have been installed, and better refractory materials utilized, both for retorts and setting. The higher the combustion temperature, however, the greater become the thermal losses due to inefficiency of regeneration and to radiation from the setting; this being more particularly so in the case of beds which have not been designed for working high temperatures, and which need a heavy draught to achieve the latter.

The installation of a waste-heat boiler to solve some of the heat losses is open to a number of objections:

(1) Capital and maintenance costs.
(2) Extra liability to breakdown.
(3) Steam is raised virtually with large coke.
(4) The fuel saved is low-grade.

The sole advantage of working at extreme combustion temperatures consists in the superior throughput obtainable, which has a beneficial effect on capital and labour charges. Against this are high fuel, high wear and tear of plant, and lack of flexibility in output. The latter disability will lead to further costs for slow fires. Equally serious are the disadvantages attendant on a relatively high rate of carbonization.

From the inner walls of the retort heat is supplied to the external surface of the charge, and carbonization proceeds through the charge from the outside to the centre. Thus most of the vapour of distillation must pass through a zone of hot coke before leaving the retort. The rate of transmission of heat between two bodies depends upon their relative temperatures, so that the greater the speed of carbonization, the higher will be the average temperature of the zone of hot coke through which the products of distillation have to pass on their escape from the more central portions of the charge.

Though similar yields of gaseous therms are obtainable at widely different speeds of carbonization, provided always that the same final retort temperature is attained, the quality and quantity of tar produced at the higher speeds seem to be adversely affected. In view of the fact that the tar make is reduced under these conditions, it is not easy to understand why an increased yield of gaseous therms is not obtained. The increased percentage of free carbon in the tar is possibly a clue, and may be evidence that some of the lighter hydrocarbons have been degraded, and their loss made up by cracking some of the tar. Confirmatory evidence of this theory would be the abnormal deposition of scurf in the case of high-speed carbonization; but I am unable to support this from personal observation.

In the present condition of the coal and residuals markets, extreme combustion temperatures do not pay. In support of this argument I direct attention to the figures given in the table. This shows the actual working results obtained on four distinct carbonizing installations during six months' operations. It may reasonably be assumed that all the installations were equally well supervised and operated. The plants differ in constructional detail, but not sufficiently to obscure the issue. On the contrary, whereas installations 1, 2, and 3 consist of plant which is new or has been modernized at a considerable outlay, installation 4 remains essentially as it was designed some twenty years ago.

It will be noticed that no reference has been made to the water content of the coke produced. Owing to the practical impossibility of correctly sampling the entire make of coke, no reliable figures are available; but the writer has personal knowledge that every precaution was effectively taken to keep the coke as dry as possible. No consideration has yet been given to capital and wear and tear costs. If we assume the charge for interest on capital in the case of installation 2 (which has the greatest thermal output per c.ft. of retort space) to be 0·5d. per therm, then the cost chargeable to plant 4 under the same heading will be approximately 0·57d. per therm. With regard to wear and tear charges, assuming these to be in inverse proportion to the thermal output

MACHINE-STOKED HORIZONTAL RETORTS.—*Comparative Statement showing Working Results obtained from Retort Houses using Various Combustion Temperatures (Six Months' Working).*

Retort House.	Approx. Combustion Temperature.	Throughput per Diem per C.Ft. of Retort.	Charge per C.Ft. of Retort.	Gas per Ton.	Coke per Ton.	Breeze per Ton.	Tar per Ton.	Free Carbon Dry Tar.	10 Oz. Liquor per Ton.	Wages per Therm.	Net Coal plus Wages per Therm.
	° C.	Lbs	Lbs.	Therms.	Cwt.	Cwt.	Gallons.	P.Ct.	Gallons.	Pence.	Pence.
1	1380	60	28·5	70·15	10·47	1·88	8·2	19·6	27·5	0·409	1·495
2	1340	62	31	69·49	10·40	1·71	9·3	20·5	27·3	0·364	1·397
3	1340	60	30	69·70	10·37	2·16	9·0	21·4	27·0	0·416	1·478
4	1220	53	26·5	70·31	11·41	1·58	10·9	13·4	26·6	0·516	1·147

Values used in arriving at costs.

Coal	30s. per ton
Coke	32s. ,, ,,
Breeze	16s. ,, ,,
Tar	6d. ,, gallon
Ammoniacal liquor	0·60d. ,, 10 oz.

per c.ft. of retort space, the charge fori nstallation 4 would be 0·97d. per therm.

Thus it will be seen from the evidence submitted that the balance is overwhelmingly in favour of working at a moderate combustion temperature. The difficulty of ascertaining accurately the final retort temperature necessary for efficiency of therm production is considerable, but it is thought to be about 1050° C. when Durham coals are to be carbonized.

Coke.—Attention having been directed to the importance of fuel economy, it may not be out of place to detail a few of the main points to be watched in endeavouring to improve the quantity and quality of coke made for sale. These are as follows:

(1) The maintenance of a satisfactory fuel level in the producer.

(2) Care in cleaning fires is important. The modern step or inclined bar grate will, if replacing a horizontal bar grate, soon save in coke the cost of its installation. If these grates are used intelligently, it is possible to withdraw the ash and clinker almost free from combustible material. The tales of extraordinary savings effected by pan-ash washers take on another complexion when it is considered that most of the pan coke might, with care in firing, have been sold as large coke.

(3) The correct adjustment of primary and secondary air. This is greatly simplified if points (1) and (2) are attended to. A thermometer permanently installed at the base of the shaft is very helpful.

(4) Great care should be taken to avoid breakage of coke. The use of shoots from retort to coke-handling plant is recommended. Where D.B. plant is in use, everything depends on maintaining the track in really sound condition. Efficient screening is important. From an economic point of view it is inexpedient to sell dirty and wet coke.

(5) It will be found economical to re-screen all breeze, using only the fines for works boilers.

Discussion.

Mr. WARREN remarked, in introducing his paper, that, if it needed an apology on account of its brevity, he ventured to hope that at any rate it was sufficiently provocative to ensure a good discussion.

CORROBORATION FROM STRATFORD.

Mr. J. S. THORMAN (Gas Light and Coke Company, Stratford) wished to thank Mr. Warren for his paper, which bristled with points for discussion. The author emphasized some very important facts in carbonizing at lower rather than maximum temperatures, such as 1400° C., in the combustion chambers. Taking the points of the paper on which he had made notes, the first was that the maximum therms could be produced with a combustion chamber temperature of 1200° C. just as at 1400° C. This statement he could completely confirm; but when such gaseous therm yield was obtained at the lower temperature, it was at the expense of lower throughput, resulting in higher wages. He reminded the members present how Mr. Gill, in his well-known carbonizing paper presented to the Institution of Gas Engineers two years ago, emphasized what a small percentage his carbonizing wages represented of the total expenditure in his retort house; and yet to-day residuals were sacrificed at a time of high residual values for—what he did not know whether he was right in terming—the "low wages bogey." Mr. Warren's reference to "flexibility" of lower-temperature carbonization as a means of somewhat reducing fuel waste with necessity for slow fires, was another important point which he would like to emphasize. For four months of this year, in his (the speaker's) works, a horizontal house carbonizing 220 tons a day, with a combustion chamber temperature of 1350° to 1400° C., was reduced deliberately to from 1200° to 1230° C. The result was that the throughput was reduced from 220 tons to 170 tons a day, and the wages thereby increased from 0·42d. to 0·56d. per therm. For this small increase in wages, the following compensation was obtained: The fuel consumption was reduced, giving a corresponding increase of fuel for sale of $\frac{3}{4}$ cwt. per ton. The therms per ton were increased from 71 to 73. This 2 therm increase was a considerable amount in these days, when they were looking for the last penny profit. The tar was increased by $\frac{1}{2}$ gallon per ton, and the quality of the tar was favourably affected by the reduction of the free carbon content from 14·6 to 9·4 p.ct. Another marked feature was in the altered analysis of the gas. With the higher-temperature carbonization, the percentage of CH_4 (methane) in the gas averaged 31; with the lower temperature, the average percentage of methane increased to 36. The calorific value of the gas naturally increased with the higher percentage of CH_4 giving an average of 594 B.Th.U. at the lower, as compared with 554 B.Th.U. at the higher carbonizing temperature. The house, as far as general conditions were concerned, was worked exactly the same. The difference was entirely due to the modified temperatures, so far as he could tell.

Now Mr. Warren had clearly indicated how, in his opinion, the degradation of the gases probably occurred at the higher temperature, and he (the speaker) could amplify this by actual figures extracted from workings of high-temperature and lower-temperature carbonization. He had before him the figures of three separate works—No. 1 working with a combustion chamber temperature of 1390° C.; No. 2, with 1360° C.; and No. 3, with 1350° C. These he was referring to as higher-temperature carbonizing figures. In the first case they had a production of 8$\frac{1}{2}$ gallons of tar per ton carbonized; in the second, 9 gallons; and in the third, 9 gallons. The percentages of free carbon in the tar were respectively 18·4, 22·4, and 21·3. He would now give the corresponding figures for three other works where the temperatures were considerably lower—No. 1, 1230° C.; No. 2, 1250° C.; and No. 3, 1230° C. In the first case the tar production was 10·9 gallons per ton; in the second, 10·7 gallons; and in the third, 10·5 gallons. The percentages of free carbon in the tar were respectively 11·8, 11·5, and 10·6. Comparing the lower-temperature figures of his own works with the period during which they worked at higher temperatures, it was noticed that the volatile matter in the coke—which was more or less indicative of the efficiency of the carbonization—showed very slight variation. Taken over a period of four months, the average volatile matter of the high-temperature coke was 1·3 p.ct., and of the lower-temperature coke 1·4 p.ct. This represented a very large number of tests, and one might say generally that there was practically no difference at all. Referring to the increased content of methane—which was very marked, and there was not the slightest doubt about the results—he was of opinion that the methane was degraded, as Mr. Warren had explained, in passing through the zone of heated coke; and assuming it was broken down to hydrogen, and carbon deposited in the form of scurf in the retort, they had an exchange of 1 c.ft. of methane at 993 B.Th.U. into 2 c.ft. of hydrogen, equal to 636 B.Th.U. This was also true of all the other hydrocarbons to a greater or less extent, if their decomposition resulted in the production of carbon. This would appear to be confirmed by the increase in calorific value which he (the speaker) obtained at his works at the lower temperatures. With no external alterations in carbonizing conditions beyond the temperature, the calorific value was increased from 556 B.Th.U. to 594 B.Th.U. He would like to ask Mr. Warren if he had made any observations to confirm this statement regarding higher methane content with lower-temperature carbonization. As to "flexibility," his own experience of these variations in temperature was that it amounted to over 30 p.ct., which was confirmed by the figures of the reduced or increased output of the house. At the higher temperature practically the maximum output was obtained, with no possible increasing flexibility; and they had all undoubtedly experienced slow fires in one part of their plant, at the same time working maximum temperatures in another—an almost unreasonable condition of affairs. With lower temperature giving a reserve of 30 p.ct. increase, when occasion demanded, the waste of fuel entailed with slow fires would be greatly reduced. In his opinion shutting-down and lighting-up a section increased the wear and tear more than continuing carbonizing at lower temperatures for from four to six months. Mr. Warren had struck the keynote—though possibly rather a high one—in his reference to the final retort temperature necessary for maximum therm production. He suggested a figure of 1050° C. He (Mr. Thorman) had spent some time in investigating this point, and had found that, when the whole charge of coke reached a temperature of 1000° C., the volatile matter left in the coke was less than 1 p.ct., which was indicative of efficient therm production.

While investigating the possibilities of the utilization of waste gases, the extra expenditure of fuel for the maintenance of high temperatures was most marked, and he had with him a number of figures taken at different temperatures. The waste gases leaving the outlet of the regenerator with a combustion chamber temperature of 1350° to 1400° C. were as high as 800° C. The figure, of course, had no meaning unless one knew the CO_2 content, and this was with 16 p.ct. CO_2. In many cases the CO_2 at the outlet of the regenerator was very much lower than this figure. At any rate, with 16 p.ct. CO_2, and with a temperature of 1400° C., the outlet temperature of the waste gases was 800° C. With a temperature of 1200° C. in a similar setting, the waste gases were leaving at 600° C. This was evidence of what they paid in the way of fuel in order to maintain a high combustion chamber temperature. The only benefit, so far as he could understand, was the lower wages due to higher throughput.

VALUE OF WASTE-HEAT BOILERS.

Mr. Thorman proceeded to say that he could not altogether agree with Mr. Warren's criticisms of the value of waste-heat boilers. The first point he referred to was capital costs. They all knew that when they were going to instal waste-heat boilers they had to buy them, and so, of course, there was some capital cost involved, but it was very low; and the output of steam by a waste-heat boiler under most conditions

would be more than twice the output for the same capital expended on Lancashire boilers. The second point was liability to breakdown. In installing a system of waste-heat boilers, one of course had to take a number of precautions to see that they did not break down, but these were comparatively simple. He had run his own works for thirteen months now with the whole of the steam load from two waste-heat boilers, and he had never had a moment's anxiety or any breakdown whatever. It would have been a serious matter for the works if either of his boilers had failed from any cause, for they were dependent upon them absolutely. For two months he ran Lancashire boilers at the other end of the steam line, on slow fires for emergency, but they got tired of this waste of fuel. The third point made by Mr. Warren was that steam was raised with large coke. In connection with a horizontal retort house, large coke was of necessity used in the generators. With waste-heat boilers attached to the outlet of the installation, the steam was raised from the fuel after it had performed its full duty in maintaining the carbonizing temperatures. Therefore he could not altogether see how, when tacking a waste-heat boiler on to the waste-gas flues of a horizontal setting, one could say that steam was generated from large fuel. The large fuel was used for carbonizing; and steam was raised from gases which would otherwise have gone off into the atmosphere to pollute the district. The other argument was that the fuel saved after the installation of waste-heat boilers was only low-grade. He quite agreed that on a gas-works they generally used their poorest fuel for steam raising under solid-fuel fired boilers, but he thought the general experience would be that (chain-grate boilers excepted) the fuel usually found in boiler houses contained from 30 to 50 p.ct. over ¾ in. size. Fuel of such size, well graded, commanded a ready sale at a price quite equal to that of large coke.

LOW IN SUMMER; HIGH IN WINTER.

Mr. J. WESLEY WHIMSTER (Bath) remarked that the author showed clearly the saving of fuel by lower-temperature carbonization. This had been his own experience, and it raised a very big point. He (Mr. Whimster) had been for some years a believer in this carbonization at lower temperatures, but he was being converted to having working both low and high—low in the summer, and high in the winter. It might sound rather incongruous, but he looked at it in this way: Assume a power plant, with varying output. When the output was at its maximum, the whole of the engines would be going; but as it decreased, certain engines would be shut-off, so that those which were running would be doing so at the highest state of efficiency. In general practice, this was how the carbonizing plant had been run. Now assume a retort house carbonizing 200 tons a day. In the winter the whole of the beds would be going; but as the output decreased, settings would be let-down gradually, until probably one-half of the house was at work in the summer. This was how the power plant was run, but was it right in the case of a retort house? He did not think it was, and for this reason: Everybody knew that the repairs needed in a retort house were principally due to letting-down and lighting-up. As far as wages were concerned, if they had to reduce the output from 200 tons to 100 tons a day, whether they used half the beds or the whole the wages would be the same—that was, if the wages were based on so much per charge, or so many charges per man, as was the modern system. As regarded the wear and tear, this would be reduced by running the whole of the retorts at the lower temperature during the period of smaller output, and repairs and renewals would be less. He thought the aim would more and more become to have a retort house in which the whole of the beds were put to work and run continuously until worn out; the temperature being reduced as the output dropped. With modern styles of generator furnaces, no repairs to the furnaces should in a general way require to be done except at times of re-setting. Should any minor repairs be needed in the meantime, they could be done without letting-out the bed.

DIRECTLY OPPOSITE RESULTS.

Mr. LAWRIE TREWBY (Mill Hill) said they had heard of the good results arising from the lowering of carbonization temperatures, and perhaps he might be permitted to relate what his own experience had been. A year ago they were round about a temperature of 1200° C., and the results were 12,500 c.ft. per ton, or about 68 therms. Then the temperature was raised to 1300° C., and the results were 13,300 c.ft. per ton, or over 70 therms. The wages, of course, were reduced, and the throughput naturally very much more. These results were secured with Yorkshire coal, and he took it that the figures of which they had been hearing were obtained on Durham. He did not know whether the class of coal used would affect the matter, but the results were the exact opposite of what Mr. Warren had found.

Dr. R. LESSING (London) remarked that he had drawn attention before to the fact that the very excessive temperatures which were so frequently employed to obtain a high yield of gas were absolutely unnecessary, in order to accomplish what was, after all, the first object of putting coal into a retort—namely, to decompose the coal. Decomposition of coal and formation of coke structure were actually finished at a temperature of 500° C., and this was, of course, the point at which true low-temperature carbonization ought to stop. As a matter of fact, however, the low-temperature people very frequently went above this, and approached temperatures which used to be employed in gas making some fifty or sixty years ago. In decomposing the coal, which operation was completed at about 500° C., they had practically done everything they could in the retort, so far as the solid substance was concerned. They had released all the volatile matter, and what happened subsequently at a higher temperature was that they dealt with these volatile substances, which were already let loose and had an independent existence. They submitted them to a high-temperature cracking process, and it was in this process that they increased the gas yield, decreased the tar yield, and increased very considerably the percentage of free carbon in the tar. This free carbon percentage in the tar, together with the amount of free-carbon which was deposited in the mouthpieces and ascension pipes in the form of scurf, was, as he had stated on previous occasions, a reserve store on which they could draw if they wanted to improve their yield per ton of coal.

A SUGGESTION FOR THE FUTURE.

One could conceive—he hoped he was not too visionary—a method of carbonizing at a very low temperature, and then, in suitable separate plant, treating the volatile matter after it had been released, at the correct temperature which was necessary in order to get the economically most desirable maximum of gas out of it. Temperatures of 1000° C. and above were undesirable. When exposed to a temperature of 1100° C., methane was decomposed into hydrogen, with the exception of about 5 p.ct. One could practically entirely decompose coal gas, purified or crude, by passing it through a retort kept at a little above 1000° C., and get almost pure hydrogen, mixed with what CO and nitrogen were in the gas before. Now, this decomposition of methane was certainly undesirable; but it actually took place in practice. When a very high temperature was reached, the methane went down, and they lost in therms what they had gained in volume. Mr. Warren mentioned the degradation of the tar and the deposition of free carbon as evidence of decomposition of the lighter hydrocarbons. Although this was true to an extent, he believed the principal decomposition was that of the heavy tar, which was the very primary decomposition product of coal. Of course, this carbon was lost as far as the gas was concerned, and it was of no use in the tar.

In discussions on the form of plant to be used, they had been apt to lose sight entirely of the composition of coal, nor was the operation of carbonizing entirely a matter of temperatures. A question had been asked in the course of the discussion as to whether Yorkshire coal would behave in the same way as Durham coal. *Qua* coal, he believed there would not be a great deal of difference, though there would be some. Where, however, a very great difference did come in, and where many of the discrepancies that were being found in actual working results arose, was in connection with the admixture of inert matter in the coal substance. Some ten years ago he had raised the subject of the catalytic influence of the ash constituents in coal on the process of carbonization, before the North British Association of Gas Managers (William Young Memorial Lecture, 1914). During the past two years, he had carried out some research work on this point, and the fact had now been clearly established that, not only should the amount of ash in the coal be partly classed as an inert diluent, and partly as an actual factor influencing carbonization, but that the chemical composition of the ash had a vital influence on the carbonization of coal. In a paper which would be published shortly, and which he had read before the Chemical Society, he had shown that if they took a coal containing a minimum of ash, and then added to it inorganic constituents such as occurred in the ash, the carbonization was affected according to the nature of these substances. To such an extent was this the case, that differences in coke yield of about 12 p.ct. or more were obtained from one and the same sample under identical working conditions. That was to say, by adding one substance they might get 65 p.ct. of coke, and by adding another substance, or by adding no substance at all, the result would be 53 p.ct. of coke. One lesson they had to learn from this investigation was that in practical working they must insist on the coal being purified to a much greater extent than it was to-day, and even to a greater extent than could be done to-day, and that consequently new methods must be evolved for supplying to the gas-works coal free from inert and inorganic substances.

THE AUTHOR'S REPLY.

Mr. WARREN remarked that he was a little disappointed at the distinctly confirmatory tone of the discussion. As regards his critics, he would like to point out that in his paper he was not regarding carbonization as a purely gas-making process, but rather as a money-making process. Mr. Thorman appeared to be in entire agreement with him, except on the point of waste-heat boilers. He had been asked whether he had any evidence as to the increase in methane content of the gas with the lower-temperature carbonization. Of course, he had evidence of this, though not with him at the moment. As to waste-heat boilers, he was assuming that a boiler plant existed on the gas-works, and consequently that additional capital expenditure would be necessary in order to instal waste-heat boilers. In referring to increased liability to breakdown, he intended to convey that the carbonizing plant itself was subjected to this, not that the waste-heat boilers had such increased liability over the ordinary steam-raising plant. Anything that tended to increase the vulnerability of the carbonizing plant was, in his opinion, undesirable. Then with regard to waste-heat boilers raising steam by best coke—there was no question that the settings were wasting heat, otherwise there would be no use for the waste-heat boilers; and the settings were being fired with best coke. He was suggesting an alternative to the addition of waste-heat boilers—namely, by preventing the waste of heat from the coke; and therefore he could reasonably assume that, if the waste-heat boiler had been added, it would have been working on best coke. Mr. Trewby had stated that, by alteration of his combustion chamber temperature from round about 1200° C. to some 1300° C. he had increased his therms and his throughput, and this was a consummation he would have expected; but he did not know whether Mr. Trewby had worked out his pecuniary results. Had he taken into consideration fuel, and tar, and ammonia? If he did this, perhaps he would find another complexion on the matter. He had to thank Dr. Lessing for putting him right about the degradation of the lighter hydrocarbons. He had visualized that they were decomposed and deposited carbon in the tar, and that a portion of the tar was cracked and formed fresh lighter hydrocarbons to go forward with the gas; but he did not pretend to any deep chemical knowledge, and so probably was wrong.

"Gas as a Public Servant."—This was the subject on which Mr. F. W. Goodenough, Controller of the Sales Department of the Gas Light and Coke Company, addressed the East Ham Chamber of Commerce last week. Mr. Goodenough stated that the Company took out of the local area—East Ham and district—for gas supplied about £775,000 a year, and paid back in rates £175,000. They paid in wages about £1,000,000 a year. This represented wages paid at Beckton, and at the offices at Barking, Stratford, and Ilford. Therefore the districts mentioned were about £400,000 to the good after paying their gas bills.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

AUTUMN GENERAL MEETING.

THE Autumn General Meeting of the Association was held last Thursday afternoon, in the Grand Hotel, Birmingham. Mr. C. H. Carder (the President) having taken up an appointment at Rio de Janeiro, the chair was occupied by Mr. W. E. CATON, of Oxford (the Vice-President). Two papers on vertical retort practice provided plenty of points for discussion; and, at its close, the feeling was general that the meeting had been highly profitable.

THE LATE MR. W. A. SAPEY.

The CHAIRMAN, at the outset, remarked that it was his sad duty to refer to the loss the Association had sustained through the death on July 2 last of one of their members, Mr. W. A. Sapey, who was Engineer and Secretary of the Tamworth Gas Light and Coke Company. It was hardly necessary for him to refer to the high esteem in which Mr. Sapey was held, not only by the members of their Association, but throughout the gas industry. His cheerful temperament and charming personality endeared him to all with whom he came in contact. Expressions of regret and condolence with the wife and family were sent by the Association, who were also represented at the funeral.

The members present joined themselves with these expressions by rising silently in their places.

THE PRESIDENT'S GOOD WISHES.

The CHAIRMAN said that, though absent, Mr. Carder had not forgotten them, for he had sent a cablegram: "Best wishes successful meeting Midland Association."

It was agreed that the Hon. Secretary should write the President thanking him for his kind message, and informing him of the results of the meeting.

The HON. SECRETARY (Mr. T. Thornton, of Rowley Regis) read the minutes of the annual and spring general meetings, and they were confirmed. He also intimated the receipt of a number of apologies for absence, the senders including Mr. J. Ferguson Bell, President of the Institution of Gas Engineers, and officers of other District Associations.

In accordance with the power given to them, he continued, the Committee had to report that the Vice-President had been elected as the Association's representative on the Council of the Institution of Gas Engineers.

NEW MEMBERS.

The following new members were balloted for, and subsequently declared to have been duly elected:

Mr. Ernest Hardiker, Gas Engineer, Smethwick.
Mr. William Henry Reed, Gas Manager, Warwick.

NEW OFFICERS.

The HON. SECRETARY announced that no nominations had been received by the Committee, and so they recommended the following as office bearers for the ensuing year:

President.—Mr. W. E. Caton, of Oxford.
Vice-President.—Mr. F. C. Briggs, of Dudley.
New Members of Committee.—Messrs. Harold Davies (Chesterfield), Arthur Roberts (Hereford), and Hubert Pooley (Leicester).
Hon. Auditors.—Messrs. W. G. S. Cranmer (Willenhall) and A. S. Foster (Stourport).
Hon. Secretary and Treasurer.—Mr. T. Thornton, of Rowley Regis.

These recommendations were heartily approved by the meeting.

Mr. R S. RAMSDEN (Leamington) proposed Mr. Caton as President, and Mr. GEORGE HELPS (Nuneaton) seconded, with the remark that they could not have a better man.

The CHAIRMAN assured the members that he would do his best as President, and would hope at the end of his term of office to leave the Association in an even better position than it was now. Continuing, he proposed Mr. Briggs as Vice-President, and declared that, when his time came, that gentleman would certainly make an excellent President. They all knew the good work he had done at Dudley.

Mr. C. M. D. BELTON (Shrewsbury) seconded Mr. Briggs's election.

"B.C.G.A." DISTRICT CONFERENCE AT LEICESTER.

The CHAIRMAN remarked that they were fortunate in having with them Mr. Mason, who had something to say which would be of interest to them.

Mr. W. M. MASON (Manager of the British Commercial Gas Association) said the business which brought him before them that day was to present a suggestion that, as heretofore, if it could possibly be arranged, there should be a "B.C.G.A." District Conference in the Midlands some time during next spring. Sometimes one heard it argued that there were too many meetings; but criticism of this nature often came from gentlemen who did not altogether realize the importance of the business that had to be tackled at these meetings. From a local point of view it was certainly desirable that these district conferences should be held. On such occasions questions which might prove of the utmost importance to the future of the whole industry could be brought before the public in a full and proper manner—such questions as coal conservation, electrical competition, prejudice, and ignorance. In the current issue of the "GAS JOURNAL" there was reference to a case which proved the need of enlightenment—even in the ranks of prominent medical officers of health—on the subject of the uses of gas. Invitations for such a conference as he was referring to had been received from two important towns in the area—Leicester and Smethwick. It was not for him to suggest a choice, but perhaps the members would give the "B.C.G.A." some lead by indicating which they thought would be the better place for this conference.

The CHAIRMAN thought there was no doubt that a "B.C.G.A." district conference in the Midlands would prove beneficial; and on his proposition the meeting decided in favour of Leicester.

A MEMBER suggested that it would be well to extend invitations to the conference to chairmen of corporations, district councils, gas committees, and gas companies.

Mr. MASON said it was a very good idea, and his Association made it a practice to invite the chairmen and engineers of local gas undertakings. There was no reason why others, also, should not attend—particularly medical officers of health. In the coming series of conferences one of the subjects to be dealt with might be "Gas and Health," and such a matter should be addressed to as wide an audience as possible.

Mr. HUBERT POOLEY (Leicester) thought the members were very kind to decide that the conference should be held in Leicester; and he felt sure that Leicester would do its part to make the meeting a success. If he remembered rightly, Leicester was the first town in the Provinces to have a district conference, and everything then went off very well indeed.

PAPERS READ.

The following papers were then read and discussed:

"Carbonization in Continuous-Intermittent Verticals," by Mr. Frederick Shewring, of Stratford-on-Avon.
"Notes on the Working of Vertical Retorts at Foleshill Gas-Works," by Mr. Charles F. Tooby, of Coventry.

Mr. Shewring's paper, with a report of the discussion, appears on p. 653 of this issue. Mr. Tooby's paper and discussion will be given next week.

The authors were heartily thanked for their contributions on the proposition of the CHAIRMAN.

Waste Heat and Surplus Gas from Coke Ovens.

This is the title of a paper which was read by Mr. I. C. F. Statham at a recent meeting of the Midland Institution of Mining Engineers, and which provoked an interesting discussion. Mr. John Bass said that the practice of burning surplus gas under boilers appeared to be the least efficient method of utilization. The best way was to use it in gas engines. In this connection the mechanical difficulties were considerable; and he had found that it took a plant of three engines to keep one running. Mr. D. H. Currer-Briggs mentioned that, at the collieries with which he was connected, since 1907 they had had about 1000 H.P. in gas engines working with very few stoppages. All the engines had been low-speed and bulky, but had run extremely well. When they changed to a large double-cylinder engine, they had less success. Prof. Douglas Hay remarked that the best way of using gas from coke ovens would be for general industrial purposes outside the collieries. If local gas undertakings, owing to developments, could take coke-oven gas, the problem would be simplified. With regard to gas-engines, he had had under observation for a good many years a high-speed engine of the vertical type, which had undoubtedly given excellent service. Its maintenance cost was very low, it had been extraordinarily free from breakdown trouble, and had been such a success that a similar engine, more modern in design, was being installed by the same company to produce power for colliery purposes. He thought the reason why gas engines were not more extensively used at collieries was because they dare not rely on coke-oven gas. There were strikes, &c., which might cause an interruption in the continuity of supply. From this point of view he thought the best use of gas would be for steam raising. Mr. P. W. Hambly said that the use of surplus gas for lighting purposes would undoubtedly increase in the near future. Dr. A. Parker, of Leeds University, criticizing the suggestion that coke-oven gas was most valuable to the gas industry, said the trouble was that coke-oven gas supply was unreliable. A gas undertaking that purchased coke-oven gas must have a stand-by plant which could be brought into use quickly in case of emergency. Consequently coke-oven gas was not worth as much to the gas undertaking as the cost of production of gas from their own plant.

CARBONIZING IN CONTINUOUS-INTERMITTENT VERTICALS.

By FREDERICK SHEWRING, of Stratford-on-Avon.

[A Paper read before the Midland Association of Gas Engineers and Managers, Nov. 27.]

The title "Continuous-Intermittent Verticals" seems contradictory, but by way of explanation I may say that the plant is continuous in gas manufacture and intermittent in coal feed and coke discharge. With the exception of the hoist, which can be worked by steam, hydraulic power, or electricity, there is no mechanical plant to operate or maintain. The installation was erected in 1915 by Messrs. Holmes-Winstanley; and the following is a brief description of the plant and the method of working.

The settings are built as units of four and two retorts; the bed of four retorts having two producers, and the bed of two retorts one producer. Heating the retorts is effected by passing the producer gases backwards and forwards along the sides of the retorts in a zig-zag direction; secondary air being admitted at various points. Pre-heated secondary air is obtained by circulation round the cooling chambers at the base of the retorts. A separate chimney with dampers controls each setting. The retorts, built-up with grooved and tongued bricks, are 25 ft. long, tapered from 4 ft. 9 in. by 21 in. at the bottom to 3 ft. 4 in. by 15 in. at the top, with base castings set at an angle of 45° and terminating in a mouthpiece with an air-tight discharging door. From the coke discharging door the producers are also fed direct with coke from the retort (see fig. 1). The quantity is conveniently regulated by an inner drop-plate door actuated by a hand lever. Superimposed on the retorts are coal hoppers, each having a capacity of about 3 tons. Convenient poking holes are provided in the off-take casting and at the base of the coal hopper. There is a valve to each gas outlet from the retort. This enables each retort to be shut-off entirely, or the valve can be adjusted to control independently the pressure in the retort, without affecting the other retorts or altering the retort-house governor. There are no hydraulic seals. The gas and liquid products pass along the gas mains to a common separating tank at the end of the setting, and an off-take main is connected thereto to convey the tar and liquid away. The retort-house governor is fixed on the gas main in close proximity to this apparatus.

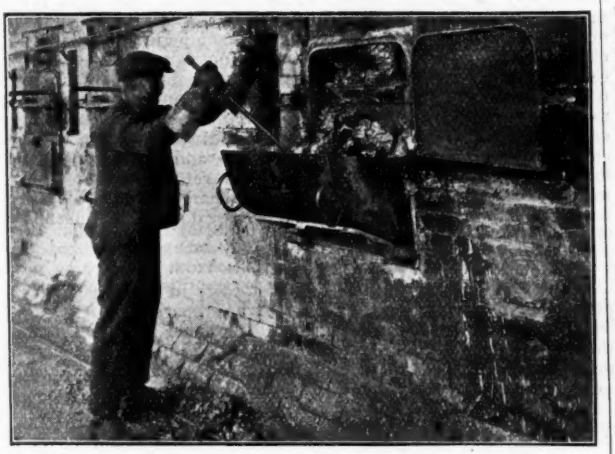


Fig. 1.

Fig. 2 is a typical chart taken on the collecting mains. The markings on the chart clearly indicate the time of coke withdrawal and the downward movement of the mass inside the retort. A railway siding runs alongside the vertical plant, and the coal is unloaded direct from the railway trucks by the stokers into a bogie which holds about 1 ton (see fig. 3). This is run along a narrow-gauge track into the hoist, and conveyed to the coal hoppers.

Coke is withdrawn every three hours, and the drawings are arranged at 1½-hour intervals. The coal may be said to move down the retort every three hours. The quantity of coke taken out is such that the coal in the top part of the retort near the gas outlet assumes an oily exterior. For a few feet lower down the retort the coal against the walls becomes plastic shortly after the mass of coal has shifted down. Some of the light hydrocarbons are evolved at this point, and, owing to the low temperature and the absence of free-heated space as in partly-filled horizontals, cracking is prevented. The dropping of the coal in the retort is immediately followed by a rapid evolution of gas. The amount of coke withdrawn every three hours is approximately 6 cwt. (for method of withdrawal see fig. 4). The retorts being tapered, the falling disturbs or opens out the coal, and so creates fissures which allow a quicker passage of the gases. The fissures would no doubt close, or partially close, again by the swelling of the coal as carbonization proceeded; but in the lower portion of the retort, where the coal has emerged to the coke stage, I should imagine that fissures would exist until the next dropping period. The structure of the coke in consequence of the above-mentioned conditions is different from horizontal or coke-oven coke, and its lightness and open structure enhance its value as a fuel for domestic purposes.

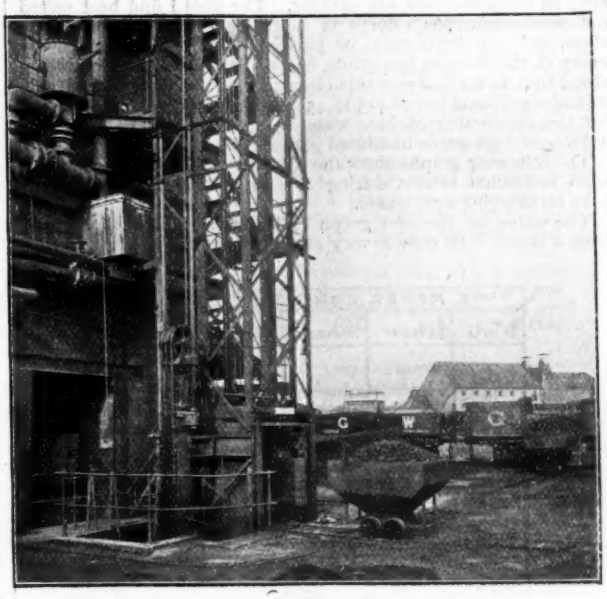


Fig. 3.

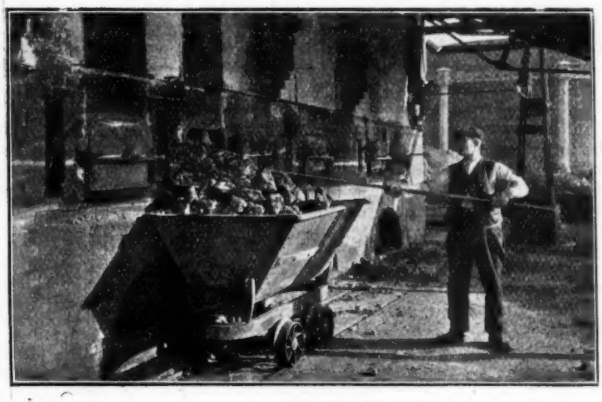


Fig. 4.

Some years ago trouble was experienced due to tar and ammonium chloride deposits in the gas-collecting mains. When I took over the plant, I installed a small pump for flushing the mains with tar and virgin liquor; and since then we have not had any block-

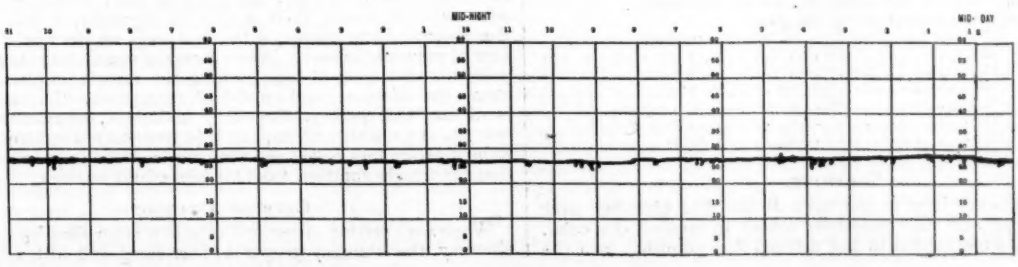
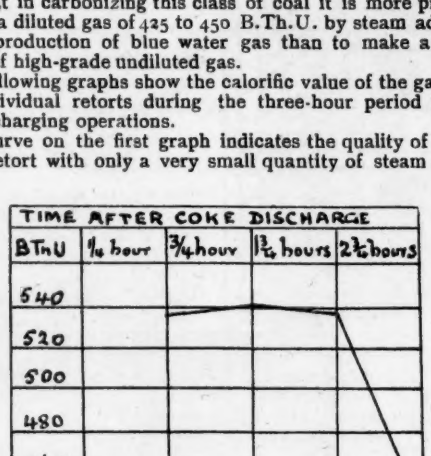


FIG. 2.

ages to inconvenience gas making. The coal I find best suited for semi-continuous retorts is large nuts of the non-caking class, not too dense, rich, or sticky. This description covers many of the cheaper low-grade coals. It can readily be understood that in carbonizing this class of coal it is more profitable to make a diluted gas of 425 to 450 B.Th.U. by steam admission for the production of blue water gas than to make a smaller volume of high-grade undiluted gas.

The following graphs show the calorific value of the gas taken from individual retorts during the three-hour period between coke discharging operations.

The curve on the first graph indicates the quality of the gas from a retort with only a very small quantity of steam entering



the mouthpiece. In the second graph the retort was continuously steamed near the bottom with superheated steam. I find that high results invariably follow high heats, and we frequently work at 1260° C. in the first, and 1290° C. in the second combustion chamber. The temperatures are regularly taken with an optical pyrometer.

Set out below are one week's working results with one bed of four and one bed of two retorts at work.

Coal carbonized, 147 tons. Gas made, 2,261,600 c.ft. Average calorific value, 442 B.Th.U. Gas made per ton, 15,385 c.ft. Therms per ton, 68.

Coal and Carbonizing Costs.

	£ s. d.	£ s. d.
147 tons of coal at 30s. 7d.	224 15 9	
*6 stokers (2 per 8-hour shift) at £3 12s.	21 12 0	
Odd man examines mains and attends to watering of retort-house governor	0 8 0	
		246 15 9

*The stokers' duties comprise the working of the vertical plant, including clinkering fires and dealing with ashes, unloading coal from railway trucks and conveying to coal hoppers, firing the steam boilers for works use, and attending to exhausters and pumps.

Credit Residuals Sold.

Coke sold, 68 tons 7 cwt. (9·3 cwt. per ton of coal carbonized) at 32s. 6d.	111 1 4	
Tar sold 12 tons 3 cwt. 2 qrs. at £3 (14·92 gallons per ton of coal carbonized)	36 10 6	
Sulphate of ammonia, 32 cwt. 3 qrs. 7 lbs. at £6 5s. (25 lbs. per ton of coal carbonized)	10 5 1	
		157 16 11
Net cost of gas		£88 18 10

This is equal to 9·3d. per 1000 c.ft., or 2d. per therm.

The following is an analysis of the gas:

	P.Ct.
CO_2	7·7
O_2	0·5
CO	9·5
C_nH_m	1·5
CH_4	23·7
H_2	36·3
N_2	20·8

STEAMING.

Wet steam is admitted in the coke discharging chamber near the mouthpiece, and this materially assists in cooling the coke. Steam is also superheated in the setting, and admitted into the retort itself. The size of nozzles now fitted is $\frac{3}{16}$ in. dia., and the steam pressure regulator is set at 20 lbs. I have never been entirely satisfied with the steaming results; and I have to confess to being envious of those who publish results showing wonderful increases in therms in converting a 500 B.Th.U. gas into a 400 B.Th.U. gas by simply turning on the steam valve. At times the CO content of the gas has been 12 p.ct., and under the same external conditions the quantity has not exceeded 7 p.ct. There has been indication that the steam has not been decomposed in its travel through the retort. The fact may be accounted for by fissures in the coke, or shrinkage of the coke from the walls of the retorts leaving a free passage for the steam. I am inclined to think that more regular results in steaming are attainable in smaller section retorts.

SCURFING.

The carbonizing capacity of any plant is dependent in some measure on the length of time the retorts have regularly to stand off for scurfing. If the retorts have to be scurfed every month or six weeks (which I understand is the custom with continuous verticals), it is apparent that an allowance has to be made when considering the number of beds or retorts necessary to keep in action to meet maximum requirements. This importance is accentuated when the daily output fluctuates considerably and holder accommodation is on the small side. To have to keep vertical retorts standing off is costly, the inroad on fuel consumption is noticeable, and the coke sold per ton of coal carbonized consequently suffers. I have not found it necessary to empty the retorts for scurfing more than once in every three months. At times some retorts have gone much longer. Occasionally when carbonizing a richer coal it has been advisable to clear off with an iron bar a carbon deposit which accumulates round the gas offtake. The retort is then only shut off for an hour or so. The reason why the retorts require to be scurfed so little is, in my opinion, due to two causes. The first is that a mixture of air and steam is swept up the retort during each period of coke discharge. This condition, as you know, is not favourable to scurf retention on the retort walls. The air and steam would tend to use up the carbon. The actual time of discharge per retort is two to three minutes. Secondly, the fall of the mass of coal and coke inside the retort during the discharging operation, being sudden, has a wearing effect on the carbon, and at times it dislodges slabs of carbon from the sides of the retort. It is possible to retard the ingress of air at times of discharging by the liberal use of steam introduced near the discharging door. This method is usually followed.

COKE AND FUEL CONSUMPTION.

When I considered the probable fuel costs in working an exposed semi-continuous vertical plant, I was prepared for high coke consumption for heating the settings. It seemed inevitable that the radiation loss would be considerable. Temperatures were taken on the outside walls and producers of the settings, and the average figures are as follows:

Outside Walls of Setting.

Near first combustion chamber	150° to 176° Fahr.
5 ft. higher up	78° ,, 96° ,,
4 ft. ,, ,,	178° ,, 180° ,,
3 ft. ,, ,,	120° ,, 122° ,,
Atmospheric temperature	56° Fahr.

Producers.

Top of producer	220° to 310° Fahr.
Front of ,,	186° ,, 190° ,,
Near the furnace door	114° ,, 106° ,,

The question of conserving some of this heat was considered, but as the settings are old it was not thought worth while to attempt anything until the beds were rebuilt. One setting has just been reset, and Moler non-conducting bricks have been introduced in part of the exterior walls. The setting has not yet been started up, so I cannot give comparative figures. With the producers the insulating was a simple matter, and the front and top were cased with 3-in. Moler bricks. There has been an appreciable reduction of temperature since their adoption, and the comparative temperatures are:

Top of producer	123° to 184° Fahr.
Front of ,,	122° ,, 140° ,,
Near the furnace door	104° Fahr.

Precaution was taken to build the non-conducting brickwork after the settings had been heated up, so that any cracks in the brickwork could be pointed before being hidden and inaccessible. My conclusion regarding high fuel consumption was not borne-out in practice. The coke sold per ton of coal carbonized for two years was 9·04 cwt.; and for one year, when the two beds were worked nearer their maximum capacity, it was 9·3 cwt. For steam-raising purposes the fuel used on the works is a mixture of coke and breeze. Apart from the usual steam engines and pumps, steam is used for steaming the retorts, sulphate of ammonia manufacture, and tar dehydrating plant. The coke made is of excellent quality, silver grey in colour, invariably open in texture, of good size, clean, and free from excess moisture. Customers prefer this coke, and soon noticed the improvement over that previously supplied from the horizontal settings.

CHIMNEY DRAUGHT.

When each setting of vertical retorts is controlled by a separate chimney, the chimney proper is short compared with a specially-

built stack common to all beds. We have occasionally noticed pressure in the producer and the combustion flues of the settings. This I attributed to atmospheric conditions influencing the chimney pull. To see to what extent the chimney draught varied, we connected a sensitive recording register to the outlet damper flue; and charts taken over a period of weeks revealed no appreciable variation in pull. This result surprised me, for when I investigated this subject [see "JOURNAL," April 29, 1913, p. 316] in connection with horizontals, a decided variation in pull was recorded on charts. The pressure in producers referred to is probably due to wind force acting on the primary-air intakes near the furnace, or to ingress of air in the secondary-air ports. The pressure shows itself in the sight-box holes of the producer gas uptake flues or combustion flues. Very little or no inconvenience has been caused in working in consequence; and I only refer to the matter in passing, as I cannot recall having read or heard of any reference to it before. The temperature at the top of these separate short stacks would be higher than that of a main chimney common to all the beds. Our average temperature at the outlet damper is in the neighbourhood of 950° Fahr. We have not installed waste-heat boilers.

Discussion.

Mr. C. M. D. BELTON (Shrewsbury) thought Mr. Shewring deserved their thanks for the straightforward manner in which he had brought his difficulties and results before the meeting. The size of the plant really determined some of the operations. First of all one was led to inquire as to the method of controlling the withdrawal of coke from the retort. Apparently it was determined by the operator by means of his poking rod, when he opened the discharging door. He took it the opening was rather restricted, and if the coke was not already fractured to any considerable extent, it probably needed breaking off; and he assumed, therefore, that the man who operated the door limited the amount of discharge to the capacity of the buggy. The carbonizing results were rather interesting, and Mr. Shewring was to be congratulated upon the amount of coke per ton of coal carbonized which he had for sale. He was, however, somewhat astonished at the analysis of the gas. One saw from this that the total amount of inerts came to 29 p.ct. Of course, it was rather unfair to deduct the whole of this amount; but if they did, it would be found that the make per ton was about 11,000 c.ft. He was not proposing to criticize the author, as he understood he was not responsible for the erection of the plant, and had to make the best he could of it; but the steaming efficiency seemed open to some improvement. One would like to see less nitrogen in the gas, and a larger proportion of CO would indicate that the steam was being properly decomposed. At present things would seem to point to a considerable amount of air being admitted; and this view was corroborated by the statement that the operation of scurfing was necessary only once in three months. He had given no figures regarding draughts or vacuum, and these would be interesting. He hinted that it was possible to retard the ingress of air at times of discharging by the liberal use of steam introduced near the discharging door. The chimney draught was not given, but one feared that an unnecessarily large proportion of heat was being wasted, considering that the highest temperature stated for the combustion chambers was 1290° C., and yet the temperature of the waste gases was over 900° C.

Mr. HAROLD DAVIES (Chesterfield) inquired as to the material of which the settings were constructed. As to the question of the dilution of the gas by steam admission for the production of blue water gas, it appeared to him, from the analysis of the gas—7·7 p.ct. CO_2 and 20·8 p.ct. nitrogen—that air was responsible for a large proportion of this dilution.

Mr. F. C. BRIGGS (Dudley) said the author was to be congratulated upon his courage in coming forward and laying himself open to criticism by giving figures which he himself knew were not the best results that could be obtained with vertical retorts. They were the real working results of the setting; whether or not Mr. Shewring was responsible for this setting, did not matter. He (the speaker) was a very enthusiastic vertical retort man at the moment—purely by conversion, and not from inherent tendencies—but he had not gone far enough yet to know what maintenance entailed. Obviously the labour cost of this plant was high; but on a small works one could not cut men in half, and there was a minimum below which one could not go with advantage. The best thing had been done in eliminating machinery, so as to utilize to the full this minimum number of men—two per shift. If, however, any difficulty arose about getting labour, he would prefer to have machinery rather than to be dependent on men. It seemed to be an inherent defect of the plant, as shown by the paper, that the quality of the gas varied rapidly and considerably; and this quality was not the best that could be got out of the coal. On a continuous vertical plant one could get an absolutely steady line for 24 hours on end, of whatever quality one wished, which could be varied as rapidly as might be desired. In other words, it was absolutely under control. He had made in his verticals 500 B.Th.U. gas when he wanted to, brought it down to 450 B.Th.U. at will, and had kept it steady for 24 hours together, with varying qualities of coal. In Mr. Shewring's plant, one was dependent so much on the men; and the further one could get away from the human factor, the better would be the working. With a continuous vertical installation, one could very largely overcome this factor. In the author's setting, it was left to a man to regulate the coke, which appeared to be another defect. Mr. Shewring suggested that rather cheaper-grade coals were the best in this plant, which seemed a pity. In his (the speaker's) view, it always paid to buy the best coal—especially when situated, as the author was, a considerable distance from the mines. There were the same freightage and wagon hire involved, and one had to buy the same inerts in the coal. He had made tests at Dudley; and at the prices they had to pay it was most profitable to use the best. The temperatures which Mr. Shewring worked were very low. At Dudley they were running 1350° to 1400° C. in their combustion chambers. With a really decent temperature, one did get better results. He noticed that for the coal which Mr. Shewring called fairly low grade he paid a high price, and this might account for the charge for the gas.

Mr. SHEWRING: That is the price delivered in the works.

Mr. BRIGGS (continuing) said he agreed with the author as to the reason why he did not have to scurf often—there was a sort of revivification *in situ* process going on. He was scurfing all the time. [Laughter.] Mention was made of scurfing verticals every six weeks. One was instructed to do this, and started doing it; but it was possible to run longer. There was a factor of safety in scurfing every six weeks; one could run (say) eight weeks, in case of a sudden heavy demand coming along. The author gave coke sold, but this was a difficult figure to judge fuel consumption by; it depended on the coal one was using. Could he give any figures of actual fuel consumption? The question of pressure in the producers was interesting. The author seemed to regard it as a nuisance, but he (Mr. Briggs) thought it was the best thing one could have.

Mr. R. S. RAMSDEN (Leamington) pointed out that, with a works making about 100 million c.ft. a year, and having a railway rate and wagon hire of 10s. 6d. a ton, the author was selling gas at 3s. 10d. per 1000 c.ft., and satisfying his consumers. This was a very creditable result in these days.

CONSTANT QUALITY THE GREAT THING.

Mr. G. C. PEARSON (Birmingham) pointed out that the great thing in gas manufacture, in order to satisfy consumers, was to maintain a constant quality. It did not matter so much whether a high or a low standard was fixed, so long as the figure was kept constant. Consumers' appliances were set for a certain value; and if the gas was much above or below this, there would be trouble. He noticed from the chart that the gas varied between 540 and 440 B.Th.U., and the author mentioned that he was short of holder accommodation. This no doubt meant that at times he was working in and out of his holder, and sending very poor or very good gas, as the case might be, out to the town.

Mr. HUBERT POOLEY (Leicester), referring to Mr. Briggs's remark that the cost of labour at Stratford-on-Avon was high, said he thought, if they took the weekly wages and calculated on the 2¼ million c.ft. of gas made, the cost would run out to something under 2¼d. per 1000 c.ft. Considering all that the duties of the stokers comprised, this was very low, and the author was to be congratulated on his results. The difficulties encountered in a small works were in some respects much greater than those in a big works. The problem of maintaining a constant quality was apt to be more difficult, but there did seem to be great variation, which might be cured. The holder trouble, however, was always with him under present conditions, and perhaps this handicapped him to such an extent that he could not do as he wished.

The CHAIRMAN (Mr. W. E. Caton, of Oxford), touching upon the question of coke discharge, said his experience led him to think that it would be necessary to poke every piece out. Did the author find any difficulty in getting it out? Did the 9·3 cwt. of coke per ton of coal carbonized include the amount used for steam raising on the works, or was it the quantity actually sold.

Mr. SHEWRING: The quantity actually sold.

The CHAIRMAN remarked that they had had a very good discussion, and owed the author their thanks for the manner in which he had set forth the facts.

THE REPLY OF THE AUTHOR.

Mr. SHEWRING, in the course of his reply to the various points raised by the speakers, said several references had been made to the coke discharge as being a difficult operation. Considering that one could easily discharge 6 cwt. of coke from the retort in two minutes, it could be understood that there was no difficulty in poking it down. Inside the mouthpiece there was a little inner drop-plate, and immediately this was lowered the coke began to slide out. The man stood by with a small bar, which he now and again pushed against the coke. If "green" coal got down the retort, sticking would naturally result, and poking down would be required; but this was a very rare occurrence. The suggestion had been thrown out that it was a difficult plant to control as regards the amount of coke taken out, but one soon got to know the throughput. The quality of the gas being emitted from the retort could be ascertained from the top of the setting, and one could very well judge, after a little experience, whether or not it was necessary to take out more coke. It seemed to be thought that there was a difficulty regarding the quality of gas, because of the variation in the two charts. They had taken the two qualities to show the effect of steaming. It must be remembered that when they were making 400 B.Th.U. gas at the tail-end of the charge in one retort, they were turning out 450 or 500 B.Th.U. gas from the other, so that the mixed gases really averaged things, and they kept the quality at what they wished it to be. He believed his average for some months had been 425 to 440 B.Th.U., and he maintained the quality within these limits quite comfortably. Mr. Belton had drawn attention to the amount of nitrogen in the gas. Of course, it was high; but they had the results as taken by an experienced chemist occasionally engaged by him. They must bear in mind that he was not running a new installation, and when a plant had been at work for years there were invariably cracks and other little faults which were difficult to put right. No doubt in some cases furnace gases were being admitted, or there was ingress of air. He had, however, taken analyses from a number of the retorts independently as the gas was made during the three-hourly period, and he would give them the results of a couple of tests. With one retort the minimum nitrogen content of the gas was 6·3 p.ct., the maximum 13·6 p.ct., and the average 10·7 p.ct. over three hours. Another retort gave a minimum nitrogen content of 12·6 p.ct., a maximum of 21·9 p.ct., and an average over the three hours of 16·9 p.ct. He had worked his chimneys under different degrees of vacuum on various occasions, and had found he could do better when working at a very low vacuum. He was now working at 1½-tenths vacuum on the chimney, and was getting better results than with a higher vacuum. The retort-house governor was set to give 2-tenths pull. With the exception of the producers, the settings were built of high-grade fireclay; there was no silica in the retort itself. He could not agree that the labour costs were high; considering the size of the works and the fact that they had no men to pay for unloading coal, they were low. It was just possible that in the plant Mr. Briggs was referring to he had to pay men to unload the coal and wheel it to the breakers. If so, this must

be included as a carbonizing cost. There was also looking after the works boilers and engines. Mr. Briggs might have men to do this, and they would have to be paid, and the wages included in the cost of production. The only items not included in the cost of production in the comparison he had drawn up were general maintenance of works, loading-up the coke, and running the sulphate plant, which he did not consider as carbonizing costs. There was something in what Mr. Briggs had said about the quality of coal, but one had to be guided by ease of working. With a more sticky coal, he would have greater trouble, and the results would suffer. Thus in his particular case it did not pay to use high-grade coals. He was sorry not to have any figures of coke actually used in the settings; but he was more interested in what he could turn into cash, and the figures were taken over twelve months' production. Speaking personally, he did not favour pressure in the settings. He found that when they had such pressure, there was a lower pressure at the top of the retorts, and the results were not so good. Mr. Ramsden had mentioned that the price of gas at Stratford-on-Avon was 3s. 10d. per 1000 c.ft. As a matter of fact, the charges actually were 3s. 6d. to 3s. 10d., *less* 5 p.ct., and for power 1s. 10d. to 2s. 11d. per 1000 c.ft.

DISTRICT CO-OPERATIVE ADVERTISING.

By NORTON H. HUMPHRYS.

This subject is novel only in the extent of its possible adoption by groups composed of a few neighbouring gas undertakings, as the British Commercial Gas Association have operated it from the commencement in favour of periodicals which are largely circulated in all parts of the country. They have extended it not only to the principal business centres such as Manchester or Birmingham, but also to less important county or district newspapers. All these notices come before present and prospective users of gas; and a venture such as the front page of the "Daily Mail" probably goes before a majority of the districts represented by the Association. An advertisement in a news sheet published in Manchester, for example, will not be limited to customers or residents in the area supplied by the Corporation Gas Committee, but will be read in all parts of Lancashire, and find its way afield in all directions; and as much applies to less important localities. The benefits may extend to fifty or more districts.

Occasionally—very occasionally—one hears of a gas manager, a relic of former times, who does not believe in advertisement; but I have not seen a formal protest stating reasons, either to the Association or to the Technical Press. A more frequent drawback is that directors do not believe in it. Yet, with few exceptions, local advertising on an adequate scale is confined to undertakings of magnitude equal to the possession of a special publicity department. The unbelievers in advertising enterprise are not numerous; but many, including some who preach, do not practise—and this in consequence of indifference rather than lack of faith. Either the exertion of raising an annual subscription has taken the wind out of their sails, or they tacitly assume that the Association will do all that is necessary and cover the whole ground, and that therefore supplementary effort is superfluous. Some look shyly on a substantial development of business as bringing an increase of capital investment and other difficulties in its train; others discountenance additional expense in any form, believing in saving rather than earning. But will a standstill policy hold the ground, in the face of active and, perhaps, Government-aided competition? Under modern conditions, can business of any kind be successfully conducted on lines that were prevalent in the middle of the nineteenth century? If the present output, together with a comfortable 6s. or so per 1000 c.ft., can be maintained, well and good. But is the position sound? The British Commercial Gas Association, from the first, have emphasized the fact that anything approaching the full benefit of advertising enterprise cannot be assured unless the subscription to No. 30, Grosvenor Gardens, is seconded and supplemented by local effort. They have prepared an immense amount of Press and illustrative matter suitable for district circulation, covering all requirements and ranging from the modest single-column one inch, to the whole page of a "daily;" or in the forms of stamps, stickers, envelope and note-paper headings, match-boxes, playing cards, enclosure leaflets and folders, pamphlets, books, &c., &c.; to an extent which totally precludes excuses as to lack of time or ability equal to preparation of suitable matter, or means of obtaining it. These important achievements have not been entered on for the fun of the thing; and they have been supplemented by private effort, by meetings of salesmen's circles, and by communications to the Technical Press. to an extent that proves a live advertising policy to be a universal requirement rather than a hobby for those whose lines are in pleasant places.

Just the ones who need advertising enterprise are the strongest opponents to its adoption. There is no standing still in these days. Everything is moving forward or backward. Let every reader ask himself, Which is my direction?

On first insight to gas-works management, many years ago, the writer was greatly impressed with the activities of traders in a position to supply gas-works apparatus or materials, in the direction of securing business. While the gas office did not advertise, inform, or solicit, almost every post brought leaflets, pamphlets, and occasionally valuable and expensive books. Visits from representatives in every department were a matter of almost daily occurrence. An early impression was that much of this was merely waste of energy, paper, and ink; but a little experience showed that there was method in the madness. Many of these documents were observed to be intentionally supplied with sufficient useful technical information to warrant a place in a systematic filing plan, rather than a bee-line to the waste-paper basket. Any subject should be capable of being traced by methods more expeditious than a search through the whole heap; and a subject index card system is required, because many of the communications, like a dictionary, treat of a large number of diverse subjects. The travelling representatives, as a rule, possessed so much technical information that summarily to show them to the door was a mistake.

A natural inference was that all these manufacturers or agents had established the fact that a selling department, even costing an amount in comparison with which the annual subscription to the National Gas Council is a trifle, was a remunerative proposition. If otherwise, curtailment of such effort might be looked for. So much being admitted, why should the gas industry run to the other extreme, and suppose that gas possessed some unique quality that rendered a selling department superfluous? A presentation of these views to older and more experienced gas men than the writer, was received with the proverbial cold blanket. The general objection was *cui bono*. Business was stable and progressive; the maximum dividend allowed by Parliament was secure. What else was wanted? So selling was quiescent until electricity and the incandescent gas burner came along. There is a general impression abroad, that anything not worth advertising is not worth buying; and competitors did not hesitate to utilize it by the suggestion that selling enterprise applied to an old-fashioned and decrepit industry was much the same thing as flogging a dead horse.

These considerations are a prelude to a suggestion as to the feasibility of extending co-operative advertising to small gas undertakings, as instanced by the following example which will find many reflections in out-of-the-way parts. Take the case of a town, perhaps a county town, with a population of about 30,000. In a leading thoroughfare will be found the head office of the Chronicle, Journal, or Gazette, with a sub-title covering smaller townships situated within a radius of (say) ten miles, and including the supply districts of perhaps half-a-dozen gas undertakings. As a leading medium it circulates largely over the whole, and advertisements contained in it are as likely to attract attention in all districts as in any one area. The probability is that the entire area is tarred with the same brush, and that a general advertisement would be equally applicable and equally beneficial as if any one undertaking accepted the whole responsibility. There is no advantage in publishing the name of the manager or the address of his office. A footnote "Apply at the local gas office" would answer every purpose. It might appear weekly, fortnightly, or monthly, and contain matter appropriate to the season or any local conditions. Possibly arrangements could be made with the British Commercial Gas Association respecting administration; thus securing the advantage of experience. Or the undertakings concerned could form a small committee to carry out details, who already have much information available in the specimen sheets issued by the Association.

The expenses could be met by a levy per million c.ft. of gas sold. Assume that the co-operating undertakings include—

A (central) selling	150	millions,	41·1	p.ct.	of the	total.
B	50	,,	13·7	,,	,,	,,
C	25	,,	6·9	,,	,,	,,
D	70	,,	19·2	,,	,,	,,
E	30	,,	8·3	,,	,,	,,
F	40	,,	10·9	,,	,,	,,
	365		100·0			

If the total outlay was £100 per annum, the individual payments would range from A, £41 2s., to C, £6 18s. Each undertaking would get as much advantage from collective payments within these limits as from an individual outlay of £100. The smallest undertaking would probably collect a gross income of about £8000, and the total income represented would be (say) £100,000. The total net profit might be taken as £20,000, so that the outlay would be about 0·5 p.ct. Or, to put it in another way, the levy would be at the rate of 5s. 4¾d. per million c.ft.

Recovery of Unburned Fuel from Ashes.

In a short review on this subject in the October issue of "Combustion," Mr. Sterling H. Bunnell, a New York Consulting Engineer, mentions the magnetic separator. This, he says, is only applicable to ash which is of small size; and even then a considerable percentage of non-combustible silica is not retained by the drum long enough to prevent it from falling into the coke. Tests on this separator in Germany, published in a report on the recovery of fuel from glass-furnace ash, show that very little coke escapes, but that the percentage of ash left in the coke is from 30 to 50. The result is the recovery of a useful quantity of fuel, but fuel of an extremely low grade, which can only be burned by mixing it with a much larger proportion of fresh fuel. The machine requires direct current for magnetization, and therefore usually needs a rotary converter or motor-generator, which adds to its cost. A drawback with this plant is that many coals do not produce a magnetic ash.

MIDLAND JUNIOR GAS ASSOCIATION.

There was a large attendance of members at a special meeting of the Association on Friday, Nov. 21, in the Birmingham Council House, when an important discussion took place on the subject of

TOWN GAS ENGINES IN COMPETITION WITH OTHER FORMS OF POWER.

The discussion arose out of the Presidential Address delivered by Mr. Harry Clark on Oct. 31, 1924, when a proposal was carried that the "power" section of his address would form an interesting subject for consideration.

Mr. HARRY CLARK, who presided, supplemented his address, and he was followed by Mr. J. W. Walthow (Messrs. Crossley Bros.) and Mr. W. E. Stevenson (National Gas Engine Company), whose contributions afforded a good basis for the ensuing discussion.

THE PRESIDENT'S STATEMENT.

Mr. CLARK said: Dealing with the first suggestion in my address, to reduce substantially the price of gas for engines over 20 B.H.P.—if the gas industry is determined to retain and increase the power load, then we shall have to be content with a much smaller margin over the net cost of the gas into the holders, bearing in mind that the distribution costs for the power load are small when compared with other methods of using gas—such as gas fires, cookers, &c. I have no desire to belittle the tremendous importance of gas fires and cookers, but would point out that gas fires are only used during the winter months, and then, generally speaking, for intermittent use, and cooker ovens for an hour or so about three times a week. Experience has clearly proved that gas engines, with a constant eight-hour day load for 44 hours each week, and for 50 weeks in the year, are easily the best customers for consuming gas. Therefore, as a gas user, the engine stands in a very special position, and the securing and retaining of such constant day loads is a matter of great concern, and fully justifies exceptional measures. When we closely examine the amount of gas consumed for different sizes of engines, we find it almost a common occurrence for a 20-B.H.P. engine to consume nearly 1 million c.ft. of gas per annum, which is equivalent to the amount used in a whole street of household consumers. So from whatever point of view the question of the power load is looked at, the fact remains that this is a source of revenue which requires special attention.

I submit that if we can supply gas in the neighbourhood of 1s. 6d. per 1000 c.ft., or its therm equivalent, we place ourselves in a favourable position to meet the severe competition, whether it is in the form of electricity from town or bulk supply, or from producer gas or crude oil. The amount of gas used for power purposes for several undertakings ranges from 10 to 22 p.ct. of the total output, which suggests that we are indeed slow if we do not make a definite attempt to maintain this load, bearing in mind that there is no additional capital expenditure required, and the distribution costs are very low. Careful attention should be given to the fact that, if we desire to obtain an increased consumption of gas equivalent to the 20-B.H.P. engine mentioned, the approximate total capital cost of new mains, services, meters, cookers, supply pipes, &c., for consumers in a new district would be £766, *plus* the depreciation and maintenance costs. I am reminded of an instance where the total capital cost of laying a gas main and services to supply only 37 consumers amounted to no less than £1185. The total amount of gas taken in one year was only 673,500 c.ft., and there are no immediate prospects of increasing this.

Concerning my second suggestion—of supplying gas engines on hire—I am fully convinced that to let them out on hire up to 60 B.H.P. is a sound commercial proposition, and will eventually become an additional part of our present hire system. The total capital invested in gas appliances on hire in the industry amounts to millions of pounds; and when we consider the security and the constant revenue from the power load, what argument can be brought forward against my proposal to increase the capital already so invested? Undertakings hardly pause to consider spending capital to manufacture gas, so why not do more to safeguard the selling side, for it is obvious that the latter is of equal importance? We must realize that the industry is in a unique position for supplying engines on hire, for we have the two leading engine makers in the country, with whom we have all been associated for many years, fully prepared to support this new venture with suitable terms, which deserve our very serious consideration. The presence of two leading representatives of those firms here this evening is an indication of their views on the matter, and I fail to see why, with such co-operation as has been manifested in the past, we cannot inaugurate some scheme which will materially benefit all concerned.

I have on view a photograph of a new gas engine working by the side of an electric motor, which has now been removed. The consumer states that since the gas engine was fixed his power bill has been reduced by 50 p.ct. This is conclusive proof that, for a constant day load, town gas easily holds the field. The gas industry will not maintain its position or grow unless more courage and enterprise are shown.

Discussion.

Mr. J. W. WALTHOW observed that Mr. Clark in his address had asked for their attention to dangers ahead in the gas industry unless a drastic change could be brought about which would promote and encourage the further use of town gas for power purposes. Summarized, the chief points and recommendations made by Mr. Clark with regard to the use of town gas for power were:

(1) The necessity for cheaper gas.
(2) The proposal to supply gas engines on hire.

It was of no use to hoodwink themselves as to the reason why the town gas engine was not being more generally installed as a power unit. The main reason was that, generally speaking, town gas was too costly. Many gas undertakings were in serious danger of losing their present consumers of gas for power, due to competition from electricity and the crude oil engine. This was specially so where gas engines at present installed were of an obsolete type and uneconomical in gas consumption. Mr. Clark had given certain figures to illustrate the working costs. In order to amplify this information, the following table showed comparative figures for electricity, town gas, suction gas, and crude oil.

Table showing Comparative Fuel Consumptions and Costs for Electricity, Town Gas, Suction Gas, and Oil Engines.

Electricity at 1½d. per Unit.	Cost per Actual B.H.P. per hour = 1·25d. per B.H.P. hour.						
Town Gas Engine.	Consumption per B.H.P. at Full Load.	Cost per B.H.P. hour with gas at 3s.	2s. 6d.	2s.	1s. 6d.	1s. per 1000 c.ft.	
Size, 25 B.H.P.	21 c.ft.	0·75	0·63	0·50	0·38	0·25	Pence per B.H.P. hour.
,, 50 ,,	20 ,,	0·72	0·60	0·48	0·36	0·24	
,, 100 ,,	19 ,,	0·68	0·57	0·46	0·34	0·23	
Suction Gas Engine.	Consumption per B.H.P. at Full Load.	Cost per B.H.P. hour (including stand-by losses) Anthracite at 50s. a ton.					
Size, 25 B.H.P.	1·1 lb.	0·29 pence per B.H.P. hour					
,, 50 ,,	0·95 ,,	0·25 ,, ,, ,, ,,					
,, 100 ,,	0·90 ,,	0·24 ,, ,, ,, ,,					
Crude Oil Engine.	Consumption per B.H.P. at Full Load.	Cost per B.H.P. hour. Fuel oil at 100s. per ton.					
Size, 25 B.H.P.	0·50 lb.	0·27 pence per B.H.P. hour					
,, 50 ,,	0·46 ,,	0·25 ,, ,, ,, ,,					
,, 100 ,,	0·43 ,,	0·23 ,, ,, ,, ,,					

NOTE.—For suction gas a small extra charge should be added to cover attendance on gas plant.

This table would permit of more exact comparisons to be made of the cost of power according to the size and type of engine under consideration. From these figures it would be seen that to-day the crude oil engine with fuel oil costing £5 per ton was easily the cheapest power obtainable. It was about equal to town gas at 1s. per 1000 c.ft. The average price of town gas in this country was nearer 3s. per 1000 c.ft., so that around this figure the town gas engine had no chance in straight competition. The figures given for the suction gas engine required attendance charges adding to make them really comparable. Competition from the electric motor was in rather a different category. Floor space might be a consideration, and many power users were prepared to pay more for the advantages of electric driving; but not above a certain margin. There were conditions where electric driving might be the best proposition—as, for example, in the case of intermittent load working, when the motor or motors could be stopped and started at will, and so the cost of electric driving became comparatively cheap. There were, on the other hand, many users of electricity for power who were profoundly disappointed at its high working costs, and who could ill afford to pay these charges. Where steady loads were to be carried for many hours a day, then electric driving was often very costly. Taking the average price, they could assume electricity in this country was about 1½d. per unit, except to large users. This was equivalent to 1·25d. per B.H.P.

TOWN GAS ENGINES.

The town gas engine ranked next to the electric motor for general convenience, and because very little attention was required. The modern engine had many improvements with which they were all conversant. It started-up instantly from cold; it had graduated impulse governing, giving quiet working and steady driving; it was highly efficient in gas consumption, and automatic lubrication was provided, so that no attention was required after starting-up, which was done by means of compressed air; there were no stand-by losses, and the modern town gas engine occupied considerably less room than did the older types. Again, the town gas engine did not require an oil-fuel storage tank or pump, as were required with the crude oil engine installation. The gas supply was obtainable at any time by merely turning on a tap at the main. A town gas engine was extremely simple in construction, and worked at lower pressures than did the oil engine. It was absolutely reliable as a prime mover. If with all these advantages the price of town gas for power could be reduced to make this obtainable within (say) 50 p.ct. above the cost when using a crude oil engine, then there was little doubt that they would have fewer cases of town gas engines being replaced by crude oil engines. Power users would instal a town gas engine in preference to an oil engine by reason of the advantages named, and especially because of the greater convenience.

ENGINES ON HIRE.

Let them consider what this meant. The electricity industry had benefited enormously by installing small electric motors on hire. For a given power, doubtless the cost of an electric motor was less than that of a gas engine, with its water tanks and piping; but when this cost was spread over a period of years, the charge per quarter for the hire of a gas engine, including maintenance and insurance, would work out at a very reasonable percentage of the gas bill, so that, except in special cases, or when the load was intermittent, the total cost of run-

ning would be much below that of electricity. There was no doubt that gas engine manufacturers—and in this respect he could speak for Messrs. Crossley Brothers, Ltd.—would be quite willing to make special terms for the supply of engines to gas undertakings where they were installed on hire terms. There was one point, however, which must not be overlooked. The letting-out of large gas engines on hire presented a greater difficulty than in the case of small engines. The setting-up of a gas engine was, as they were aware, rather more costly than installing an electric motor. The foundations, pipe-work, and water-cooling arrangements were items of expenditure which must be duly considered before agreeing to deliver and fix a gas engine on hire. In the event of a business closing down after the engine had been on hire only (say) for a year or so, it might happen that the sums of money received would not cover the installation costs, and so this would make an unprofitable deal. However, it should not be difficult to make some equitable arrangement which would cover such cases; and in any event they could be overcome after a little experience. One bad case, should it occur, would be more or less covered by a number of good ones. Meanwhile, the number of gas consumers would be conserved and increased. Large power users would no doubt prefer to purchase their own gas engines outright; and so this question of engines on hire would not enter into such cases. The inducement with them would be cheap gas.

REDUCTION OF PRICE OF GAS.

There was one aspect in connection with a reduction in the price of town gas which must be apparent, and which would require special consideration. Any price reduction made would have to operate in favour of old gas consumers as with new ones. This might entail some sacrifice; but unless it was done by the gas undertakings, there was always the danger of dissatisfied users changing their power arrangements to some other cheaper system. What they could do, therefore, was to forestall this, and make users generally more satisfied, so that they would remain as gas consumers. Every inducement should be made to extend further the use of town gas for power.

Mr. W. E. STEVENSON observed that when he was in a junior position in Birmingham, 25 years ago, his firm published a list of orders from gas companies which were supplying engines on hire-purchase; and the only two local undertakings mentioned at that time were Birmingham and Derby, to both of whom they sold an appreciable number of engines. That arrangement was discontinued, for various reasons, by Birmingham. In certain parts of the country engines were sold at present upon favourable hire-purchase terms. As to how an arrangement of simple hire, as suggested by Mr. Clark, would work out in actual practice, was open to conjecture. It was true that gas engines to-day did not meet with the same favour as before, and he could not help thinking that this was due not only to the price of gas, but to the attitude of some manufacturers in indiscriminately pushing the sale of crude-oil engines, regardless of local conditions. A manufacturer not far from Birmingham had an old slide engine which had been in use for a long period. It was giving no more than an average load of 8 B.H.P. for the whole of the week, and the cost of gas for that period was 30s. A maker recommended an oil engine, the capital charge for which was about £100 more than for a gas engine. His firm received the inquiry, and eventually secured the order for a gas engine. The engine had been running for six months, and the average weekly cost had been reduced to about 17s. Assuming oil was purchased in bulk at (say) £6 per ton, the weekly consumption for the same load would be 2 cwt. at a cost of 12s., or a saving of about 5s. per week, which was just about sufficient to meet the interest and depreciation charges on the extra outlay. About two years ago his firm received an inquiry from a china manufacturer for a 30 H.P. engine required to run night and day. An oil engine was installed. Six months later another inquiry was received for a similar sized engine; and a gas engine was installed. The explanation given for not buying another oil engine was that it was not sufficiently reliable for continuous working. It had since been ascertained that the gas engine had run continuously and satisfactorily, except on Sundays, for the whole of the time since its installation, and without a single failure. Again, just over two years ago a firm of London consulting engineers prepared a scheme for a pumping installation within twenty miles of Birmingham. Duplicate engines and pumps were installed; and to be on the safe side (as he assumed) they decided upon a gas engine of their make and a crude oil engine of another make. The information received was that the gas engine worked four days to one of the oil engine, the former being more reliable, and less costly to maintain. Moreover, there was no difficulty experienced in starting, and there were no complaints of nuisance from smell. In this case gas was 3s. 6d. per 1000 c.ft. His firm were selling oil engines in different parts of the country where the conditions were favourable; but he was of opinion that if it were possible to supply town gas in the neighbourhoods at the figure suggested by Mr. Clark, there would be no oil engines of any account sold in industrial districts of the Midlands. Could gas be supplied at 1s. 6d. per 1000 c.ft. within a reasonable period? To his mind the question of electricity for power purposes supplied from local mains was a much more vital question for the gas industry to consider. Strenuous efforts were being made by electrical engineers to secure the whole of the power load by supplying current well below the cost of production and making up for loss on this account by inflated charges for lighting purposes and by subsidies from the State for the laying of new mains in certain areas. There was no gas undertaking in the country which could or would sell gas for power at prices varying from one-fifth to one-tenth the cost of gas for domestic purposes. Mr. Stevenson insisted that a margin of saving could still be shown in favour of the gas engine as against the electric motor in most Midland districts. If they assumed an engine of 100 B.H.P. was installed, giving a constant average load of 60 B.H.P., the consumption of gas at 20 c.ft. per H.P.-hour would be 1200 c.ft. per hour, or 60,000 c.ft. per week of 50 hours. This, at 2s. 4d. per 1000 c.ft. would cost £7; at 2s. per 1000 c.ft., £6; and at 1s. 6d. per 1000 c.ft., £4 10s. With an electric motor working under ideal conditions, the consumption of current would be not less than 0·85 of a unit per H.P. per hour, or 2550 units per week. At 1½d. per unit the cost would be £13 5s. 7d.; at 1d., £10 12s. 6d.; and at ½d., £7 19s. 5d. For an oil engine under identical conditions the fuel alone would on a basis of 0·5 lb. per B.H.P.-hour be a total quantity of 13½ cwt., which at £6 per ton would cost £4 1s., and at £5 per ton would cost £3 7s. 6d. The cost of lubrication and attention would have to be added. The up-to-date gas engine was easy to start, and the maintenance charges were low. Insurance companies charged almost the same premium for insurance against breakdown for an electric motor as for a gas engine, though the capital charge for the engine was the higher. It was reliably estimated that 75 p.ct. of the accidents which took place with gas engines were due to neglect and to avoidable causes. The gas engine was more favourable in maintenance charges than any prime-mover available to-day.

Mr. R. G. MARSH (Birmingham) said that in Birmingham competition was very keen in connection with power problems. Admittedly they had been losing a certain amount of ground by reason of competition from oil engines; and he agreed that if it were to be effectively met the price of gas must be reduced. It was obvious that nothing but a drastic reduction would meet the case; and it would appear that until circumstances in connection with the sale of residual and manufacturing costs were considerably readjusted, there was no immediate hope of a sufficient reduction. They might, of course, reduce the price to power users. If the price were reduced to gas-engine users, manufacturers who used gas for furnace purposes would claim similar advantages. While power constituted a valuable load, and one they did not want to lose, it did not represent a large proportion of their total output. The price of gas was coming down gradually. He felt that sooner or later the balance would readjust itself, and that there was no need for any panic legislation.

Mr. C. F. W. RENDLE (Redditch) remarked that the discussion resolved itself into the one question, How were they to reduce the price of gas to such a point that it might be an effective competitor of other forms of power? Oil engines were more economical than gas engines so far as the cost of fuel was concerned. He agreed that if gas could be sold at 1s. 6d. per 1000 c.ft. it would oust oil. It was, however, fatal, as a matter of business economics, to maintain an unprofitable load. It had been suggested that the price should be lowered to the man with a gas engine. Why should one consumer be favoured more than another? The industrial load was more important than the engine load. Again, it must not be forgotten that they had to face unfair competition from State-aided electricity schemes. The electricity people could afford to give preferential terms to certain users so long as they kept up the load factor. He felt that the question of hiring gas engines was fraught with risk and difficulty, and that the time was not ripe to consider it seriously. The risk attached to the cessation of work on the part of the gas-engine user was a factor that gas producers could not afford to ignore. As to competition from electricity, the question was, he thought, largely one of convenience rather than of cost of energy. Much was to be said in favour of electricity in factories where the shops were divided and subdivided, because the current could be switched on and off in any department as required. Gas engines were excellent for full-load running; but how many factories were running at full load? The demand, in most weeks, was largely intermittent.

Mr. T. H. POULSON (Stafford) suggested that gas-engine makers might have good scope for activity in those areas where the cost of gas was very low. One of the reasons why electricity could be sold cheaply was that many municipal electric supply concerns were subsidized from the rates. Gas-works, on the other hand, were expected to yield a profit sufficient to give relief to the rates. It was, on the part of the gas-engine manufacturers, an "easy way out" to say that gas producers should reduce their prices. He submitted that, if the prices of gas engines and the cost of gas, pre-war, were compared, they might well ask if the present charges for gas engines would not bear a reduction. He agreed with the President that it was time the question as to the hiring of gas engines received attention in the industry. It seemed to him only fair that the consumer should pay fixing charges; otherwise, if the engine were given up after a relatively short time, a burden would be imposed upon the gas department.

Mr. G. E. BURDEN (Redditch) pointed out that from time to time gas engines were scrapped, and electrical equipment installed in their place. Gas concerns should inspect gas engines frequently. Something should be done to retain the power load. Perhaps something might be done to meet the engine user with regard to installation charges.

Mr. CARROCK (Messrs. Crossley Bros.) pointed out that there was something else to be considered besides the price of gas—namely, "service." The Derby Gas Company had started a power department; and this meant that the users received closer attention. This fact created confidence and faith in the Company. In his opinion town gas engines had advantages over oil engines or any other internal combustion engine. The hire-purchase system would overcome many of the difficulties which now confronted the industry; and in this connection he emphasized that the gas-engine makers would be willing to afford help to the gas companies.

The CHAIRMAN observed that a power department performed useful service, particularly in ensuring the regular periodical inspection of engines, &c.

A resolution of thanks to Messrs. Walthow and Stevenson was moved by Mr. J. H. GEE (Nechells), seconded by Mr. C. F. TOOBY (Coventry), and carried unanimously.

Grain Size and Yield and Properties of Coke.—In a study of coke properties made by Mr. G. Lambris and W. Müller and published in "Brennstoff-Chemie," samples of three gas coals and a fat coal were pulverized and separated into three sizes by sieving. Coke yield and volatile-matter content were determined for the various sizes and for the composite samples. The conclusions arrived at were: The coke yield varied irregularly with grain size, the maximum variation being 4·65 p.ct. from that of the composite. Yield variations were due mainly to variations in composition of the coal substance, which was least with the older coals. The larger the grain size the greater was the swelling of the coke.

LOW-TEMPERATURE CARBONIZATION.

By Dr. C. H. LANDER.

[A Paper read at a Meeting of the Liverpool Engineering Society on Nov. 19, 1924.]

THE carbonization of coal as practised to-day on a large scale is carried out for two main purposes:

(1) In the gas industry, where the main product is gas, and the coke and tars are bye-products.
(2) In the metallurgical coke industry, where the main product is coke, and the gas and tars are bye-products.

In both these cases the bye-products have an important bearing on the economics of the process, but the price of the main product can be to some extent regulated by the cost of its production. Carbonization is carried out at comparatively high temperatures. In the case of low-temperature carbonization there is no one main product whose price can be fixed by the cost of production. The objects are to produce (1) a smokeless fuel or semi-coke which is sufficiently free burning for use in ordinary domestic grates and generally as a substitute for many of the purposes for which the raw coal is normally employed; and (2) oils which can be used for fuel purposes in the Navy and industry and for internal combustion engines, and possibly other purposes for which at present only natural oils or their derivatives are employed. It is as yet doubtful what price the smokeless fuel will command in the open market beyond that for which raw coal can be obtained. In the same way the oils, if produced in large quantities, must compete with imported natural oils, the price of which is fixed by the world's market. Low-temperature carbonization, therefore, differs from the gas or coke industries in that the price of its products is largely fixed by circumstances over which the industry itself can exercise no control. The process is, however, an attractive one, as if it can be successfully carried out on a large scale it should go a long way towards reducing the smoke nuisance, and, at the same time, provide a home source of fuel and other oils, which is so desirable for national defence, as well as from a general point of view.

PRODUCTION OF COKE.

The characteristics of the coke depend on the coal from which it is produced; and coals which by themselves produce unsatisfactory coke can be utilized by suitable blending. The coke is, however, also affected by the conditions under which carbonization takes place. The sponge-like structure of coke results from the coal, or portions of it, softening at a temperature of 220° to 250° C., followed at about 350° C. and upwards by rapid evolution of tar vapours and gas. It is apparently this portion of the coal which forms the binding material which holds the coke together; and its amount, together with the method of treatment, determines whether the coke will be of an open spongy structure or strongly swelling, hard and compact or powdery. An excess of this portion can be utilized by blending to produce coherent coke from non-coking coals. If, as is the case in coke-oven practice, the coal is prevented from expanding, excessive bubble structure is prevented and the coke is more compact. The strength of the coke is also increased by the use of the higher temperatures in carbonization, leading to a lower volatile content in the coke and possibly also to a partial cracking of some of the gases given off and a deposition of graphitic carbon on the coke.

As has already been stated, the two chief products required from low-temperature carbonization are a free-burning smokeless fuel and oils; and the temperature in the retort is limited by the requirement that sufficient volatile matter should be left in the coke to ensure easy ignition. If the retort temperatures are too high, the oil yield suffers; consequently the requisite strength in the coke cannot be obtained by carbonizing at high temperatures. The first stage of coke formation produces a foam of plastic material, with each bubble a self-contained cell. As more gas is evolved, mutual perforation of points of contact of the cells produces a spongy mass through which the gas escapes. When the plastic state is passed, the structure remains; and the rate at which the coal is heated has a considerable bearing on the final structure obtained. In order to obtain a dense fuel with a large number of small cells uniformly distributed throughout the mass, it is necessary for the fusible portions of the coal to be a correct proportion of the whole, and also to be evenly distributed. This even distribution will not be obtained unless the coal (whether a natural coal or a blend) is more or less finely divided and mixed. Where this has been done, a compact coke can be produced. A fine bubble structure in the coke, which can be produced in this manner, also assists in the combustion of the coke. The finer the structure the greater the ratio of surface to mass, and consequently the area over which actual combustion can take place in a given weight of coke. There is probably a limit to this; for if the structure is too fine, insufficient oxygen will gain access to the surfaces. It is probable that the fineness of the bubble structure may be the chief cause of the varying chemical activity of different cokes. It is significant that Beilby, in his studies of the formation of carbon by the carbonization of sugar, and of the microstructure and properties of coke, came to the conclusion that most carbonaceous residues, from wood charcoal to the hardest coke, consist of carbon in a vitreous state and having a density of 1·85 to 1·9.

It would appear from the above that there are two methods by which a free-burning coke can be obtained at low temperatures: (1) By carbonizing a swelling coal under conditions which prevent expansion, so that the large bubbles formed are broken down mechanically. This method is difficult to carry out, as the swelling causes the coke to stick in the retorts, and makes for difficulties in discharging. (2) By intimate mixing and fine division of the fusible and non-fusible types of coal substance in such proportion that the mixture does not froth or expand.

METHODS OF HEATING.

Retorts may be classified according as they are heated externally—when the heat is conveyed to the coal by conduction through the walls of the retort and then by radiation, convection, and conduction to the coal itself—or heated internally by passing heated inert gases through the retort. Both classes may be further sub-divided according as the coal remains at rest during carbonization or is turned over mechanically or moved by gravity during the process. External and internal heating may be used simultaneously. The heat transference inside the retort depends considerably on the size of the coal and the tightness of packing. In externally heated retorts it is necessary to carbonize the coal in thin layers, as the time taken for portions in the interior of the mass of coal to heat up to a temperature approaching that of the heating surface varies roughly as the square of the distance from that surface. A thick mass of coal therefore means slow carbonization and slow throughput, with consequent high capital charges. Mechanical stirring, while it decreases the time necessary, is apt to break up the structure of the coke and result in an undue proportion of fines. When the coal passes by gravity down a vertical retort, there is much less stirring motion; but if the coal is finely divided, it is apt to pack, and there is insufficient space for the free passage of the volatiles and little scope for heating by convection inside the retort. In such a case the coal is first heated on the outside, when a layer of plastic material forms which moves gradually inwards as the carbonization proceeds. This results in a large proportion of the volatiles being forced to the retort walls, where they are exposed to the maximum temperature. Even at a temperature of 600° C. this appears to result in some cracking and loss of oils.

Sutcliffe and Evans have found that some coals when finely ground can be made into strong briquettes by pressure and without added binder. The pressure used is about 10 tons per sq. in. These briquettes can be carbonized satisfactorily in a vertical retort, the large spaces between the briquettes enabling the volatiles to escape freely and assist in the heating of the coal. Laboratory experiments show that satisfactory briquettes can be made with coarser materials at lower pressures if the coal is first heated up to a temperature of 200° to 300° C., when fusion commences but serious decomposition has not yet set in. The Fuel Research Board are studying this method; but the practical difficulties in preheating or briquetting on a large scale have not yet been overcome.

With internal heating it is obviously necessary that the heating medium should be inert and have no effect on the products, and also desirable that it should have a high specific heat. Liquids present obvious difficulties. Steam has a high specific heat, but there are practical difficulties in superheating it to the degree required, and the whole has to be condensed. This necessitates large and costly condensers and the loss of the latent heat. Stripped coal gas or producer gas is more satisfactory, and for economic reasons the latter is the medium generally employed in practice. By this method it is not necessary to carbonize in thin layers, so the retorts can deal at one time with large quantities of coal, with a considerable reduction in capital charges.

The introduction of steam into vertical gas retorts has been found advantageous, but its utility is more problematical in low-temperature work. The decomposition of the steam by carbon at 600° C. is practically negligible; and if it occurs, carbon dioxide rather than carbon monoxide is likely to be formed. On the other hand, the admission of steam near the coke exit assists in transferring some of the heat of the coke to the upper layers of the retort, and assists in sweeping away the volatiles. It may also tend to preserve the primary products of distillation. It is possible that a variation of the pressure in the retort may have considerable effect on the process. Low pressure should assist in removing the products rapidly, and possibly enable the carbonization to be carried out at a lower temperature. High pressures may assist in the cracking of some of the oils, to produce greater quantities of light spirit. The practical difficulties in departing much from atmospheric pressure, however, are great, and in practice a slight vacuum is adopted.

The desirability of blending swelling with non-coking coal has already been dealt with. It has been shown that coke breeze may be substituted for the non-coking coal; but this has the disadvantage of reducing the effective capacity of the retort by including inert matter in the charge. It is possible that the introduction of coke in this manner assists the transfer of heat by increasing the conductivity, and thus reduces the time of carbonization so that the throughput is not diminished; but much further research is necessary on this interesting aspect of the subject.

LOW-TEMPERATURE COKE.

Generally speaking, low-temperature coke contains 8 to 10 p.ct. of volatiles, as compared with some 3 p.ct. for gas coke, and still less for metallurgical coke. The greater volatile content increases its ease of ignition, and renders it more suitable for domestic use

than gas coke, although the structure of the coke probably has a marked influence on its combustibility. It shares with gas coke the advantage of producing no smoke, which simplifies the regulation of flues and reduces the labour of flue cleaning and chimney sweeping. Tests made by Dr. Margaret Fishenden show that it gives out more radiant heat than raw coal when used in domestic grates. Low-temperature coke is eminently suitable for use in gas producers; and though there are few published data on the subject, it appears very suitable for use under boilers, behaving in a manner similar to smokeless Welsh steam coal. Its disadvantage is that it is rather more bulky; but this should not apply to coke formed from briquettes. It would also appear very suitable for burning in the pulverized form; and in this case the coke need not have the strength necessary for transport and use in lumps. Some processes propose to get over the difficulty of sufficient strength in the coke by briquetting it after carbonization. The difficulty here lies in finding a suitable binder. At present the most suitable is pitch, but this results in a briquette which is not smokeless.

TAR.

The composition and amount of the tar formed depend on the conditions of carbonization and on the rapidity with which it is removed from the influence of heat and guarded from secondary decomposition. Generally speaking, the tar bears a greater resemblance to natural oils than does gas tar, and has the following general characteristics: It contains hydrocarbons chiefly of the paraffin and olefine series with some naphthenes and from 10 to 15 p.ct. of phenols. The quantity of benzene and its homologues is small, but is made up for by the presence of light paraffins such as hexane, &c. The higher phenols such as cresol are more represented than phenol itself. The content of free carbon is less than 2 p.ct., and that of pitch 35 to 40 p.ct. Nitrogenous substances such as pyridine may be present up to 1 p.ct.

The crude tar is suitable for use in Diesel engines, when dehydrated and freed from solid matter, and has a calorific value of about 16,000 to 16,500 B.Th.U. per lb. Its flash-point is too low to conform to the Admiralty specification; and any attempt to raise this by removing the light spirit results in an undue increase in the viscosity. The crude oil is not miscible with most natural oils. A process of mixing the tar with a petroleum spirit and subjecting the mixture to steam distillation results in the removal of some of the pitch and the production of a crude tar oil which is miscible in all proportions with a typical petroleum fuel oil. This process is now under investigation at H.M. Fuel Research Station and elsewhere, to test its commercial practicability. It is, of course, not necessary to utilize the oil in its crude form; and by fractionation and distillation good burning and lubricating oils can be obtained, as well as light spirit. The tar acids obtained vary considerably, but an average value is from 15 to 25 p.ct. No full investigation of low-temperature tar made by a large-scale process has yet been published.

In the fractionation of the tar, a yield of motor spirit amounting to about 10 p.ct. of the tar (or, say, 1·1 to 1·6 gallons per ton of coal) is obtained. The spirit consists chiefly of the higher paraffins with some benzene and toluene, and open-chain unsaturated compounds. A further yield of motor spirit amounting to 1·4 to 3 gallons per ton of coal can be obtained from the gas; this spirit being a mixture of saturated and unsaturated hydrocarbons, naphthenes, and complex aromatic hydrocarbons.

GAS.

As in the case of the coke and tar, the quantity and composition of the gas obtained depends on the process. When the volatiles given off remain for any length of time at the temperature of the retort, cracking takes place, which affects both the tar and the gas; and a similar effect is produced if the vapour condenses on the coal in the cooler portions of the retort, and is subsequently recarbonized. The extent to which this may take place varies considerably. Where undue cracking or dilution does not take place, the gas contains over 50 p.ct. of saturated hydrocarbons and some 20 p.ct. of hydrogen, and has a calorific value in the neighbourhood of 1000 B.Th.U. per c.ft.

While ammonia is obtainable as one of the products of low-temperature carbonization, the amount is small, and in general at present prices it is not worth the expense of recovery.

RETORTS.

It is impossible to attempt to give here any detailed description of the various types of retort that have been tried for low-temperature carbonization. Two, which are typical of the two lines of attack, may be mentioned which are of particular interest inasmuch as in each case a large installation is being erected, the steady working results of which will provide commercial data of the highest value.

PARKER PROCESS.

The first serious work on the subject as it is understood to-day is that of Parker, who devoted his energies to the development of the process in vertical cast-iron retorts. He encountered great difficulties; and the Low-Temperature Carbonization Company, the successor of the original company holding the Parker patents, reverted to the use of fireclay retorts. These proved unsatisfactory, for reasons which will be indicated later. Early this year this Company reverted to the original ideas of Parker; and they have now erected at Barnsley two standard units each capable of a throughput of 50 tons per day. In the design of this new plant full use has been made of the increased knowledge which has been available since Parker's death. One of these units recently tested by the staff of the Fuel Research Station produced the following products from one ton of Dalton Main Coal supplied in the form of washed breeze up to ½-in. pieces.

Coke	13·92 cwts.
Gas	39·6 therms. Calorific value 705 B.Th.U. average.
Tar	18·62 gallons.
Liquor	26·00 ,,
Crude spirit	1·78 ,,
Ammonium sulphate	13·55 lbs.

Arrangements are now being made for the erection of a 1000-ton a day plant in the neighbourhood of Nottingham. This plant is typical of one of the externally-heated type. For a full description of the Parker plant tested by the Fuel Research Board reference may be made to the report of the test which has been published by H.M. Stationery Office [see "JOURNAL" for Oct. 29, p. 286].

MACLAURIN PROCESS.

An interesting development is now taking place in Glasgow, where the Corporation are erecting five units of Maclaurin plant each capable of carbonizing 20 tons of coal per day. This plant is typical of one method of internal heating. In retorts of Mr. Maclaurin's design it is necessary to provide an outlet for large quantities (25,000 to 30,000 c.ft. per ton) of low-grade gas of a calorific value in the neighbourhood of 240 B.Th.U. per c.ft. In the Glasgow installation the bulk of this will be used for heating vertical retorts in the Dalmarnock Gas-Works. Data will also be obtained with a view to proving whether or not the gas obtained by the process can be economically used for the firing of boilers in the generating station.

In an experimental retort previously erected at Grangemouth, independent tests indicated yields per ton of coal to be roughly as follows:

Coke	11 cwts.
Oil	15 gallons.
Sulphate of ammonia	17 lbs.
Gas	68 therms.

EXPERIMENTAL RETORTS AT H.M. FUEL RESEARCH STATION.

The original experimental retorts at the Fuel Research Station were horizontal steel retorts externally heated. The coal was inserted in shallow trays divided into compartments by iron divisions to assist in the conduction of heat. The fuel is produced in the form of cubes (3-in. side being found a convenient size), and is quite satisfactory. The retorts are not a commercial success, owing to the small throughput and high labour costs; but they have fulfilled the main purpose for which they were erected, by furnishing many valuable data. An attempt to develop a machine working continuously with the coal in trays failed, owing to the properties of iron at the temperatures necessary introducing mechanical difficulties in the moving parts. Experiments are now being carried-out with the object of pre-briquetting the coal and then carbonizing in vertical cast-iron retorts similar to those used in the Scottish shale-oil industry.

RETORT MATERIALS.

The earlier gas retorts were made of cast iron; but as the temtures of carbonization were raised to increase the production of gas, difficulties were encountered owing to the growth of the cast-iron, which commences at about 650° C., or even lower. The recent work of H. C. H. Carpenter and others has shown the cause of this, and how it can be avoided to some extent; and growth need not now be feared at temperatures below 650° C. if the cast iron is of a suitable composition. Mild steel has also been used in some cases. It does not suffer from growth; and horizontal retorts at H.M. Fuel Research Station made of this material have been in use for some three years with no sign of deterioration. Mild steel is liable to soften if a working temperature of 600° C. is exceeded; and the retorts require careful watching in this respect.

Both cast iron and mild steel have many advantages. They can easily be made and maintained gas-tight, and they withstand corrosion. Cast iron has the advantage of cheapness where the design admits of its use, and is more rigid at the working temperature. Mild steel causes difficulties where the material is subjected to heavy stresses. At the temperatures usually employed the elastic limit is low and the metal is liable to a continuous creep when kept under load at such temperatures, even when the stresses are much below those of the yield-point, as determined for the temperature in the ordinary way. This accounts for many of the difficulties found in processes involving the mechanical conveying of the material in the retort.

There are alloy steels in existence containing nickel, chromium, or tungsten, which will stand up to the temperatures required and which are used for valves of motor-car engines and other applications where the conditions are even more severe than those in low-temperature carbonizing machines. These alloys are, however, expensive; and the cost puts them out of court at present. Prof. Carpenter has suggested that a cast iron containing chromium might have advantages from this point of view; but this has not yet been proved.

The necessity for high temperatures in ordinary gas-works practice has led to the use of refractory materials for the retorts. Such retorts are difficult to keep gas-tight at the lower temperatures, where there is no tendency for a leak to seal itself by the deposition of carbonaceous material in the cracks, as occurs at

the higher temperatures. Leaks are serious, as they result either in the dilution of the products by flue gases or in the products being burnt in the combustion chambers, which results in serious local overheating. It appears, therefore, that the best materials to use are cast iron or mild steel; but in this case care must be taken to prevent overheating, and the flame from the heating gases must not be allowed to impinge on the retort itself.

TESTS OF PLANTS.

In July last the Department of Scientific and Industrial Research were empowered by the Government to undertake under certain conditions and at the public cost tests of any promising plant for the low-temperature carbonization of coal. Such independent tests would not only furnish information of value to the Government on a question of first-rate national importance, but would assist in expediting the development of a successful process or processes for low-temperature carbonization.

The object of these tests is to place in the hands of those interested accurate technical data on the quality and quantity of yields, the throughput of the plant, the working temperatures, and the general ease of working, together with such other information as it may be possible to obtain under the limited conditions of the tests. It should be clearly understood that no attempt is made to pronounce on the commercial possibilities of plants which may be tested. The likelihood of commercial success can only finally be judged after working a plant under a steady load for a long period, and in the light of complete knowledge of local conditions such as cost of raw material, quantity of raw material available, price and markets for products, cost of labour, &c.

THE PLASTIC STATE OF COAL.

[Summary and conclusions of a thesis by G. E. Foxwell, for which the author was awarded the degree of Doctor of Science in the University of London.]

An important thesis on "The Plastic State of Coal," by Dr. G. E. Foxwell, has been published in "Fuel in Science and Practice." In the October issue of our contemporary the author summarizes his work, and the following is an extract of his conclusions.

THE PLASTIC CURVE.

Unless the path taken by the gases in escaping from the carbonizing coal is known, work in the formation and decomposition of the gaseous and vaporous products of distillation is of very little practical value as regards its application to coke-oven conditions.

In a previous paper on the "Path of Travel of the Gases" (J. Soc. Chem. Ind., 1923, 60, 193-201 T), the author has shown that the resistance of granular or porous materials such as coal and coke to the passage of gases may be expressed by the relationship:

$$m = p.S/v.l$$

where p is the pressure (mm. w.g.) necessary to pass v c.c. of gas per minute through a plug of coal of cross-sectional area S sq. cm. and length l cm. In the present thesis a new and accurate method of determining the value of m is described. The relationship between the value of m and the temperature is termed the "plastic curve"—*i.e.*, if t is the temperature in deg. C., the curve is expressed by the equivalent $m = \phi(t)$.

The general characteristics of the plastic curve are as follows: Below a certain temperature, in nearly every instance under 400° C., the value of m increases at a uniform rate. This fact can be shown to be due to the increasing viscosity of coal gas owing to the increased temperature. At this critical temperature the value of m becomes a little higher than is demanded by theory; and as the temperature rises still further, this deviation becomes still greater, and may become very great indeed. The curve finally reaches a maximum; and the value of m may remain in this neighbourhood for a considerable range of temperature, or may drop rapidly as soon as the maximum has been reached. Finally, the curve drops to a low point and continues dropping till about 900° C., when it may again start to rise on account of the viscosity of the gases.

INFLUENCE OF CONDITIONS ON THE PLASTIC CURVE.

With increased rate of heating the value of m is greater, and the curve extends over a longer range of temperature; though the initial point is little affected. With very rapid rates of heating, the curve is no longer regular, but becomes oscillatory. The size of the coal used has a considerable influence on the curve. If the whole of the coal is crushed to a given size, it is found that the finest crushing gives the highest curve; and as the size is increased, the maximum value of m and the area of the curve decrease. This points to the necessity of fine crushing with the poorer coking coals. If, on the other hand, the coal is divided into sizes by sieving, it is found that the finest fraction gives the lowest curve, owing to the presence of much fusain. When sufficient of the larger sizes of coal are present in the mixture, however, the effect of the fusain is masked, and the presence of the finer coal increases the plasticity. It is found that compression increases the height of the curve. From this it is inferred that the poorer coking coals should be as strongly compressed as possible. The nature of the plastic curve is characteristic for each coal; and this furnishes means of investigating the difference in behaviour of coals on carbonization.

TRAVEL OF THE GASES.

The slow rate of heating in the coke oven is a factor of great importance. It would be anticipated that in the vertical retort, for instance, the gases would pass up through the hot coke, and hardly anything would pass up the centre. This is to be inferred on account of the increase in plasticity caused by more rapid heating. The investigation here described only refers to the bye-product coke oven.

The total resistance of the plastic layer is termed R. Three cases are distinguished—viz., $R = o, \infty$, or some numerical value. If $R = \infty$ (no coal has yet been found for which this is so) or is sufficiently small to be considered as o, the special theory which was given in the paper previously referred to will adequately express the path taken by the gases; but where $R = x$, the "general theory" given in the thesis is required. The existence at the top of the charge of a thin plastic layer having a resistance R_T is shown, and reasons are given for assuming that $10R_T = R$. The general mathematical theory of the path of travel of the gases is given. It is shown that for mathematical reasons it is not possible to obtain an exact method of calculation, but an empirical method has been developed which gives results very closely approximating to accuracy.

The path taken by the gases will depend on the nature of the coal, the time that has elapsed since the oven was charged, the size of the coal, the amount of added water in the coal, and the temperature of the flues.

In general it is shown that:

(1) In the early stages nearly the whole of the gas passes inwards.
(2) The quantity passing from the hot zone to the cool zone is greatest at the bottom of the oven and becomes less higher up the charge. At the top of the charge it is negative on account of the existence of the top plastic layer.
(3) The employment of finely-crushed coal and of added water has the effect of making more gas travel through the hot coke.
(4) As mentioned above, the amount passing up each zone depends on the time that has elapsed since the oven was charged; and though at the commencement most of the gas passes up the cool zone, the proportion passing up this zone becomes less as the carbonization proceeds, and finally gas passes from the cool zone into the hot zone.
(5) The investigation has only been conducted up to the point at which the plastic zones travelling inwards from each wall coalesce. Shortly after this time nearly the whole of the ammonia and tar would have been evolved, and there is thus no particular interest in carrying the investigation further.

TEMPERATURE OF FORMATION AND PATH OF TRAVEL OF THE PRINCIPAL BYE-PRODUCTS.

The mode of decomposition of coal will be dependent on the conditions under which the distillation is carried out, and this will also affect the yields and nature of the bye-products. Since in practice coal is raised in temperature at the rate of 1° C. per min., it has been found necessary to make a determination of the yields of primary products evolved under these conditions between certain temperature limits.

Four coals have been investigated; these were selected as typical of coals mined in this country. By considering the difference between the laboratory yields, which give the primary products, and the works yields, it has been possible to show the extent to which changes in the yields occur during passage up the oven. It is shown that decomposition of tar takes place, resulting in increased yield of coke. Water, ammonia, and sulphuretted hydrogen are all to some extent decomposed, but the volume of gas is from 12 to 22 p.ct. higher. Benzene is not produced as a primary product, but is formed from aliphatic hydrocarbons by secondary reactions. It is further shown that there are definite critical temperatures at which the bye-products are mainly formed; and these temperature limits vary to some extent with the nature of the coal. It is further shown that there does not appear to be any relationship between the yield of tar and the percentage of β and γ compounds.

Some observations have also been made on the cause of the hardness of coke. It is shown that when coal is raised in temperature at the rate of 1° C. per min. the hardening of coke takes place between 700° and 800° C.—a temperature above that at which all coke-forming constituents have been destroyed. It is inferred that the phenomenon may be a purely physical process, or it may be due to the decomposition of the constituents of low-temperature coke with liberation of graphitic carbon. Having determined the temperatures at which the gaseous products are formed, it was found possible to discuss the path taken by each one individually. In each instance the relative proportions taking the hot and cold paths will depend on the nature and size of the coal, the amount of added water, and the time since the oven was charged. In general, all products mainly pass into the cool zone up to the ninth hour.

TAR.

At first this passes into the interior, where it is condensed; but after a time some is distilled directly into the hot zone. By the time the plastic zones begin to coalesce, the bulk is passing in this direction. When coalescence takes place, any tar previously condensed in the cool zone is again volatilized and passes into the hot zone and so away out of the oven. It must be stated that because tar is passing into the hot zone it is not necessarily subjected to temperatures so high as to effect decomposition. The temperatures at which the tar is evolved are relatively low, and there is a large evolution of gas between the zone up which the tar is passing and the wall. Consequently, diffusion is largely prevented and the tar does not have to pass up the hottest zone. It is thus not subjected to intense decomposition, but it is sufficiently heated to reduce the yield by about 40 p.ct. and to ensure almost complete conversion of the aliphatic compounds into aromatic bodies. It is a consequence of this theory that increased temperature in the oven flues will not appreciably reduce the yield of tar. This result, which is in direct opposition to the behaviour in gas retorts, has been confirmed when English coals were carbonized in America during a recent American coal strike.

AMMONIA AND BENZENE.

The ammonia must be considered side by side with the water vapour. At first all the ammonia passes up the cool zone, but later more and more takes the hot path, and the quantity doing this is increased in proportion as the percentage of added water is increased. The same remarks concerning overheating apply here as were made with regard to tar. It has been shown that the theory here developed adequately explains practical working results.

Benzene, being formed by the effect of heat on the low-temperature tar, is subjected to high temperatures throughout its passage up the charge.

PHYSICAL PHENOMENA ASSOCIATED WITH THE PLASTIC STAGE.

It is shown that non-coking coals contain appreciable quantities of β and γ compounds, and their completely non-coking character cannot be ascribed to deficiency of these bodies. These coals, however, yield a distinctive plastic curve, giving a maximum at 100° to 120° C., and hardly any maximum at 400° C. They show only slight evidence of passing through a plastic stage.

When coking coals are mixed with non-coking coals and with coke, it is found that the non-coking coals lower the plastic curve more than does coke (inert material) alone. It is as if the non-coking coals are not merely inert, but possess negative coking power. From these results it is also shown that the development of plasticity is not merely dependent on the quantity of β or γ compounds present.

On maintaining a good coking coal at a constant temperature in the plastic zone, the plastic resistance rises to a definite amount and remains there indefinitely. Plasticity is therefore a physical, not a chemical, phenomenon; and since the value of the resistance varies with the temperature at which the coal is heated, it is evident that the coal during coking passes through an orderly sequence of stages.

When a good coking coal is split up into α, β, and γ compounds, and these are mixed in the proportions in which they existed in the original coal, the mixture then being coked in a crucible over a strong flame, a coke is produced equal in all respects to that produced from the original coal; but when this mixture is heated at the rate of 3° C. per min. to determine the plastic curve, the coke is powdery, and no plasticity is developed. This important observation has led the author to put forward a new theory of coking. The theory postulates that during coke formation coals enter a succession of stages; all of these stages are passed through by a good coking coal, whereas a coal of inferior coking quality stops short at one of the intermediate stages. The behaviour of the coal on coking may be deduced from the plastic curve, which always shows certain peculiarities. These peculiarities are due to the manner in which the coal passes through its successive stages. On the basis of this theory the coking power of a coal is not due solely to the proportion of γ compounds it contains, but to the mode of extrusion of these constituents from the particles of coal. Surface tension is a factor of the utmost importance.

CHEMICAL CHANGES DURING THE PLASTIC STAGE.

From the point of view of the evolution of tar, gas, and ammonia, coal is not noticeably active during the plastic stage. The principal chemical activity is the disappearance of β and γ compounds. Since the γ compounds are always considered to be of fundamental importance in coke formation, particular attention has been paid to these, though work has also been carried out on the β compounds.

An attempt has been made to evaluate the velocity constant for the decomposition of the γ compounds. This attempt was unsuccessful, and it is shown that the physical conditions are so complex that it is not likely that any satisfactory mathematical expression will be found. It is shown, moreover, that in formulating any theory of coking, the coal must be considered as a whole, since the behaviour of the components when isolated is different from their behaviour when in their natural condition in the coal. The initial decomposition at any temperature is relatively rapid, but after a few minutes the rate becomes much slower.

INFLUENCE OF THE HISTORY OF THE COAL ON THE PLASTIC CURVE.

Preheating a coal reduces the "coking energy" as measured by the area of the plastic curve; the extent of the reduction depending on the duration of heating and on the temperature. Rapid heating up to 350° C. gives a greatly increased area on the plastic curve; and it is evident that by suitable heat treatment it should be possible to enhance the coking power of semi-coking coals appreciably. Judging by results obtained from measurements of the plastic curve, some coals deteriorate very rapidly on weathering, whereas others deteriorate very slowly. Since rapid heating increases the height of the plastic curve, the effect of weathering is particularly apparent with slow rates of heating.

There is little or no agreement between the coking index or the percentage of γ compounds in the coal and its coking properties when carbonized in the coke oven. There is likewise no numerical agreement between the area of the plastic curve and the quality of the coke; but this is not to be expected, for the plastic curve gives a picture of the manner in which coking proceeds rather than a measure of the coking power.

Coke-Oven Gas in the United States.

In his report for the past twelve months, Mr. Alexander Forward (the Secretary-Manager of the American Gas Association) says that an important feature of the gas industry in the States is the marked increase in the quantity of coke-oven gas purchased and mixed with manufactured gas for distribution to towns. In 1921 the amount of this gas purchased was 37,000 million c.ft.; in 1922, 53,300 millions; whereas last year it reached approximately 66,006 million c.ft. As a matter of fact, this last figure was about 8000 million c.ft. more than the quantity of coal gas manufactured in the same period; and it represents an increase of approximately 80 p.ct. between 1921 and 1923. It should, of course, be remembered, when comparing these coke-oven gas figures with the coal-gas figures, that some 74 p.ct. of the gas produced by United States undertakings is carburetted water gas, and only 18 p.ct. coal gas. Going further into the figures, it is found that, if the purchased coke-oven gas is added to the coal gas manufactured, the combined 1923 total shows an increase over 1921 of something like 25,000 million c.ft., as against 24,000 millions for carburetted water gas, and a percentage increase of 25, as compared with 11. From this standpoint, Mr. Forward says, the anticipated trend towards the increased use of coal gas derives justification. A reduction in the percentage of unaccounted-for gas from 9·16 in 1921 to 7·94 in 1923 is attributed by him, not only to increased efficiency, but to this larger quantity of coke-oven gas purchased.

Preventing Holder Accidents.

The recent occurrence of several accidents to gasholders has emphasized the necessity for making complete periodical inspections of these structures, to detect evidence of corrosion, distortion, and other detrimental conditions. This reflection has caused the Accident Prevention Committee of the American Gas Association to issue a bulletin on the subject, in which they say that if a holder has been in service for several years—especially if it is known to have stored gas containing hydrogen sulphide, or other deleterious matter—a thorough examination should be at once made. Should conditions warrant it, and it is impossible to make an internal inspection, plugs of metal should be taken from critical points on the crown of the holder, and the corrosion measured from these samples. The edges of the holes should be carefully calipered from time to time, to detect signs of further corrosion. Particular attention should be paid to the interior seam laps in the crown, and to the interior surfaces and plates at places close to the seams. This applies particularly to those circles near the crown plates. Holder water should be periodically tested for acidity and for heavy concentrations of harmful salts. The crown and frame should be kept free of any cinders which come from neighbouring smoke stacks; otherwise local corrosion may occur, due to their acid nature in the presence of moisture. The cups should be regularly cleaned and carefully inspected for corrosion; the guide framing should be plumbed at stated intervals; the rollers should be inspected for wear, and kept lubricated and in actual contact with the bearing surfaces; and the roller faces and the bearing surfaces should be kept free from binding rust.

Coke-Oven Gas for Power Stations.—Large quantities of coke-oven gas are supplied to power companies. One of the largest operations of this kind is the supply of gas by the Old Silkstone Collieries, Ltd., to the Yorkshire Electric Power Company, Ltd. During the year 1922-23 the Colliery Company supplied some 850 million c.ft. of gas to the Power Company for consumption under boilers for steam-raising purposes. Another example is the case of the Team By-Product Coke Company, Ltd., of Dunston-on-Tyne, who dispose of the surplus gas from 130 Otto ovens to the Newcastle Electric Supply Company's power station two miles distant. The Waste Heat and Gas Electric Generating Stations, Ltd., in their power stations at Crook and Bowden Close utilize surplus gas and waste heat from the coking plants of Messrs. Pease & Partners, Ltd., for raising steam to drive turbo-generators supplying current to the County of Durham.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Combinations of Gas and Electricity.

SIR,—Your editorial reference in the "JOURNAL" for Nov. 26 to the possibility of using the waste heat from retort settings for the generation of electricity prompts me to write and endorse your brief comments upon this matter. Such use of waste heat is undoubtedly going to be a very important factor in developing combinations of gas and electricity. It is not generally known that in some towns waste heat from the retort houses, if properly conserved and utilized, is likely to be sufficient to generate by means of steam all the electricity required in the same town. In other towns this will not be possible to the same extent; but in the majority of cases it would seem that the quantity which can by this means be generated is likely to exceed 50 units of electricity per ton of coal carbonized.

If the actual test figures quoted by Mr. J. S. Thorman, of the Stratford Works of the Gas Light and Coke Company, in his important paper on waste heat from Glover-West verticals and other carbonizing plant, before the Southern Association in November, 1923, are taken as a guide, the amount of electricity which could have been generated in that case was about 87 units per ton of coal carbonized.

It is therefore suggested that it would be advisable for the management of gas undertakings which are directly or indirectly interested in electricity, to give consideration to this important question.

119, Victoria Street, London, S.W. 1,
Nov. 28, 1924. G. M. GILL.

Dr. Travers' Critical Study of Tests on Water Gas Plant.

SIR,—In his recent paper "A Critical Study of the Published Results of Tests on Water Gas Plant," published in the "JOURNALS" for Nov. 19 and 26, pp. 510 and 580, Dr. Travers utilized the results of tests carried out by the Gas Investigation Committee of the Institution of Gas Engineers, for the purpose of comparing the quantities of heat added to the bed of fuel during the blow periods, and taken away during the run periods. Theoretically—when all factors are given their proper consideration—these two quantities should agree within certain limits of experimental error.

As calculated by Dr. Travers, the heat added to the fuel during the blow periods of the Gas Investigation Committee's Test D of the Tenth Report was 3·1475 million C.H.U. per ton of dry coke supplied to the generator, and the heat removed during the run periods was 2·83415 million C.H.U. Though the difference is 0·31335 million C.H.U., or about 10 p.ct. of the heat added during blow periods, it represents less than 2 p.ct. of the heat value of the fuel (15·7 million C.H.U.) supplied to the generator. The fuel supplied can only be weighed and sampled with certainty to within about 1 p.ct. of the true value; so that the apparently large discrepancy approaches the limit of experimental error. Dr. Travers, however, endeavours to show how this discrepancy must have been caused by (1) combustion of carbon during clinkering or loss of solid carbon up the stack, or (2) the recording of temperatures of blow and run gases much below their true values, or probably by both factors.

Dr. Travers then proceeds to make further calculations from the results of the Tenth Report, Test D, on the assumptions that the recorded temperatures of the gases were 50° C. too low, and that the carbon lost was equivalent to 5 p.ct. of the carbon consumed during the blow periods; and *according to the figures derived*, a true balance is obtained. Explanations (1) and (2) were thus put forward as definite conclusions.

With regard to these conclusions I must state emphatically that the extreme precautions taken during the tests of the Tenth Report preclude any possibility of the temperatures being in error to the extent of anything approaching 50° C. Further, it is highly improbable that so much carbon was lost during Test D of the Tenth Report. I have therefore submitted Dr. Travers' critical study to a careful examination, and find that I am in disagreement with so many points in the paper that space would not allow me to deal with them all in this communication. I wish, however, to mention a few of them.

I. The heats of reaction used by Dr. Travers are:

(a) $C+2H_2O = CO_2+2H_2$ *minus* 20,900 C.H.U.
(b) $C+H_2O = CO+H_2$ *minus* 31,000 C.H.U.

The usually accepted figures are (a) *minus* 19,000, and (b) *minus* 29,000, which differ from Dr. Travers' figures by 10 p.ct. in (a) and 7 p.ct. in (b). Dr. Travers' figures would be obtained approximately by replacing amorphous carbon by diamond.

II. No account appears to have been taken of the heat expended by the blow gases in evaporating moisture from the coke as charged into the generator. The moisture in the coke supplied in Test D of the Tenth Report was 10·8 p.ct., and correction for this item alone would reduce the discrepancy from 0·31335 million C.H.U. to approximately 0·09 million C.H.U.

III. The gaseous hydrogen which is derived from the amount of this element in the coke as supplied must also be considered. This point would affect both the heat added during the blow periods and abstracted during the run periods by approximately 0·24 million C.H.U.

It is thus clear from the points I., II., and III. just raised—quite apart from many other points which need not be considered at this stage—that Dr. Travers' paper is not based on a full and proper consideration of the subject. A. PARKER.

The University, Leeds, Nov. 26, 1924.

It was stated at a meeting of the Colne Town Council on Nov. 26 that the cost of back street lighting would amount to £2000 per year, and at present could not be undertaken.

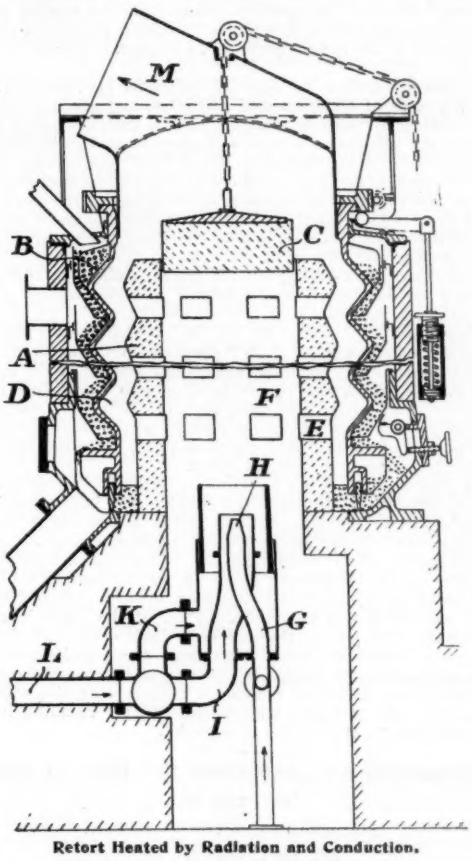
REGISTER OF PATENTS.

Distillation of Carbonaceous Substances.
No. 205,101.

KOHLENVEREDLUNG GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, of Berlin.

No. 24,848; Oct. 5, 1923. Convention date, Oct. 5, 1922.

The patentees suggest that, to overcome the loss of heat in carbonization due to bad transmission by conduction, it is preferable to use a heat-radiating body of refractory material. The latter is provided at a position near to the heating surface of the retort, and is heated by the heating gases, and in turn passes on the heat, by radiation, to the wall of the retort. If the heating gases are caused to travel along the wall of the retort, further heat is transmitted by direct contact. The invention is illustrated in the accompanying drawing.



Retort Heated by Radiation and Conduction.

The retort furnace consists substantially of a massive hollow cylinder A made of refractory material, the outer wall of which is corrugated. This cylinder is surounded by a second cylinder B of corrugated cross-section, made of cast-iron. The outer surface of this cylinder B serves as heating surface for the charge. The upper end of the hollow cylinder A is closed-in by a movable block C made of refractory material. This is moved by any suitable lifting mechanism. The annular space D, which is formed between the two cylinders, communicates with the inner space F of the cylinder A through the slots E. Heating gas is passed into the inner space from the gas pipe G, and is burnt on issuing from the burner H. The air for combustion, the quantity of which is adjustable by regulating members not illustrated, is fed in through the pipe I. For the purpose of adjusting the temperature of the heating gases, a by-pass K is mounted on the main air-inlet pipe L, through which the necessary quantity of additional air is fed to the combustion gases.

The invention operates as follows: The heating gases burn with a needle flame extending into the innner space F, and there mix with the additional air fed in through the pipe K. The action of the heating gases is first to heat the inner cylinder A from the inside outwards. From the inner space F the heating gases pass into the annular space D through the slots E and thence escape into the outer atmosphere through the outlet M, or they are further used in heat exchanging apparatus, as, for example, in a pre-heater. During their passage they heat the cylinder A from the outside, and at the same time the outer cylinder B from the inside. The effect is that the heating surface or wall of the retort is heated by being brought into direct contact with the heating gases and by radiation from the cylinder A acting as a heating body. In order that the inner cylinder may be effectively heated, the slots E are advantageously disposed principally at the lower end of the cylinder D—that is, near the burner. Thus the flame enters the space F a greater or shorter distance according to the position of the movable block C, and is forced to pass through the cylinder and the annular space D. The same or a similar effect may be secured by a different movement of the heating gases.

Production of Ammonium Chloride.—No. 211,096.

CHRISTENSON, O. L., of Stockholm.

No. 21,022; Aug. 18, 1923. Convention date, Feb. 9, 1923.

The object of this invention is to produce ammonium chloride from coal gas in such manner that the salt may be directly collected substantially free from tar and in a dry state, and thus the purification of the product from tar may be avoided. Tar is first removed from the crude gases, which are then mixed at a temperature of 100° C. with gaseous hydrochloric acid. The NH_4Cl may be deposited in suitable settling chambers, or may be precipitated in Cottrell or similar apparatus.

Low-Temperature Distillation.—No. 214,222.

RAMAGE, A. S., of Detroit.

No. 7483; March 24, 1924. Convention date, April 9, 1923.

This invention relates to the production of the maximum amount of low-temperature oil, the greatest utilization of the sensible heat of the blow gases and water gas, and the maximum conversion of nitrogen to ammonia in the low-temperature carbonization of coal in a vertical retort.

The patentee makes the following claims for his invention:

1. A process of distilling coal and producing gaseous and condensible products by passing a stream of coal counter-current to and in heat transfer relation to a current of gases formed by blasting the distillation residue of the coal alternately with air and steam. The steps consist in passing the gases produced by blasting the distillation residue with air first through closed spaces surrounding a stream of coal.

2. A process as defined in claim 1 in which the gases produced by blasting the distillation residue with steam are passed through, and in direct contact with, the coal.

3. Apparatus for carrying out the process claimed in claim 1, comprising a vertical retort, and a hollow partition having transverse communicating gas conduits.

4. Apparatus for carrying out the process claimed in claim 1, comprising a vertical retort, a hollow partition in the upper part of the retort, a group of gas conduits embracing a portion of the wall of the lower part of the retort, communicating with the hollow partition, gas conduits embracing the upper part of the retort, and a second group of gas conduits embracing another portion of the wall of the lower part of the retort and communicating with the gas conduits embracing the upper part of the retort.

5. A process for the low-temperature distillation of coal, which comprises establishing a column of material ranging in composition from coke substantially free from volatile matter at one end to green coal at the other end, in contact with heat transmitting walls. Green coal is fed to the top of the column and ash is withdrawn from the lower end. The maximum distance of the material from the walls within that zone of the column containing more than 30 p.ct. of its original volatile content ranges from about 3 in. at the point in the zone at which the material has the smallest volatile content to about 2 in. at the point at which the material has the greatest volatile content. The coke is alternately and successively blasted with air, and the resulting gases are passed in tortuous paths in contact with the wall. The incandescent coke is blown with steam, and the resulting hot gases are passed through the column of material.

Apparatus for Controlling the Flow of Gas. No. 223,102.

MOLDENHAUER, E., of Dusseldorf.

No. 1882; Jan. 23, 1924.

This invention relates to apparatus for controlling the flow of gas in pipes in accordance with the pressure of gas obtaining in the supply, and refers particularly to devices of the kind wherein a water seal is interposed in the supply pipe, and water is caused to flow into and out of the seal in response to fall and rise of pressure in the gas supply, so as to effect the closing and opening of the seal to the flow of gas. The object of the present invention is to provide an improved construction applicable for controlling pipes conveying gas from blast furnaces, &c., to gas consumers. It is characterized by the provision, in the pipe supplying water to the seal, of a cock adapted to open automatically to flood the seal when the pressure of gas drops. The water cock may be connected by mechanical or electrical means with a floating bell which is responsive to changes of pressure in the gas supply pipe; or an automatic non-return valve may be employed which opens under the influence of a head of water.

Adjustable Nozzle for Gas Burners.—No. 223,126.

MATTHES, E., of Neukolln.

No. 5435; March 3, 1924.

The nozzle consists of an outer casing with an inserted tubular element, both these parts being stamped, drawn, or pressed from sheet-iron, the adjusting needle being arranged perpendicularly to the longitudinal axis of the casing and screwed into a guide body securely held in the walls of the outer casing and of the insertion, the point of the adjusting nozzle, which is adapted to be directly operated, engaging with a hole in the opposite wall of the inserted tubular element, so that this hole may be more or less obdurated.

Fuel Distillation.—No. 223,297.

ELECTRICAL IMPROVEMENTS, LTD., of Newcastle-upon-Tyne, and WEEKS, E. G., of Dunston-on-Tyne.

No. 18,412; July, 17, 1923.

In this invention—which relates particularly, though it is not limited, to low-temperature carbonization—coke is fed into a retort separately from, but simultaneously with, the incoming fuel charge in such a manner that the coke becomes admixed with the fuel during its passage to the upper surface of the charge within the retort. The invention includes means for extracting from the retort and returning to the retort-charging apparatus a portion only of the coke residue extracted from the retort.

Low-Temperature Carbonization.—No. 223,387.

MERZ and M'LELLAN, of Newcastle-upon-Tyne, and WEEKS, E. G., of Dunston-on-Tyne.

No. 24,632; Oct. 3, 1923.

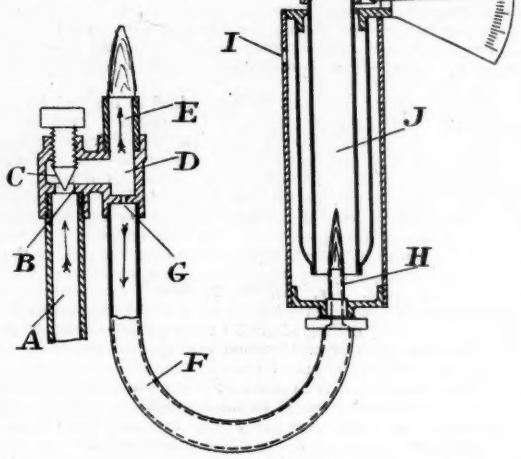
The object of this invention is to eliminate the sticking of charges in the retorts. It is found that a more efficient distillation is possible with the use of less steam and at a lower temperature if a certain amount of additional heat be generated within the retort itself by the addition to the heated steam of a regulated amount of air, so as to cause the combustion of a limited proportion of the fuel. The invention comprises a means by which this can be accomplished.

Regulating the Gas Flow to Calorimeters. No. 223,375.

STEWART, J. G., of Letchworth.

No. 23,036; Sept. 14, 1923.

This invention relates to gas flow regulators for calorimeters, of the kind in which the size of an orifice, in conjunction with the pressure drop in a stream of gas passing through it, determines the rate of flow of the gas. The accompanying drawing shows a section of the apparatus.



Gas Flow Regulator.

The gas, the calorific value of which is under examination, is supplied through pipe A, at a suitable pressure. The gas pressure forces it through the restriction B, the size of which is regulated by the adjustable screw valve C. After passage through the restriction the gas reaches the atmospheric chamber D, the inside of which is in free communication with the atmosphere by the escape opening E. Gas may leave the chamber D either by pipe E or by pipe F. Gas passing through pipe F also passes through the orifice G placed anywhere between the chamber D and the burner H. The air for combustion at the burner H enters through a restricted opening I, and the hot gases resulting from the combustion pass upwards through a chimney J to the atmosphere. The hot gases in the chimney create a suction at the burner; and this suction is utilized to suck the gas from the chamber D to the burner. Since the pressure in D cannot rise above atmospheric, it will be clear that all gas passing through the restriction B in excess of that which the burner sucks through pipe F will pass by the unrestricted escape opening E into the atmosphere, where it may be burned. The excess must be sufficient to allow for any fluctuations in the main supply caused by changes of pressure in the supply pipe A.

When the escape opening E is at the same level as the calorimeter burner the flow to the latter will be determined by the suction, by the area of the orifice G, by any resistance offered to flow by the pipe F, and by the specific gravity of the gas. As it is generally necessary that the volumetric flow should be independent of the specific gravity, a correction is made for this factor by raising the level of the escape opening E a suitable height above that of the calorimeter burner. The calorimeter shown is of the hot chimney type in which the expansion of a steel tube is a measure of the calorific value. The heat measuring portion of this calorimeter forms no part of the present invention, and it may be replaced by the equivalent parts of any other type of calorimeter, with means added, if necessary, to create a vacuum at the burner. The restricted opening B and its adjustable screw may, in certain cases, be dispensed with. For example, they are unnecessary when the gas is sucked from the gas main by means of a pump the discharge of which can be regulated to give the necessary flow. While the escape opening E should offer practically no resistance to the flow

of gas from the chamber D, some resistance may be introduced to balance the small suction created at the escape opening by the combustion of the excess gas. As a means of adjusting the reading of the calorimeter, the air flow to the burner may be made adjustable; and an automatic variation in this flow with variation of the calorific value may be provided, for example, by connecting a shutter to the pointer or other moving part of the mechanism, and making it move in the path of the air flowing through the opening I.

Regulating the Gas Supply to Atmospheric Burners. No. 223,413.

FRICKER, E. H., of Exeter.

No. 27,631; Nov. 3, 1923.

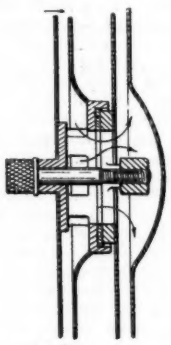
This invention relates to means for regulating the gas supply to atmospheric burners for gas fires and the like, and refers to means of that type wherein a coiled spring is disposed within, and is of a smaller diameter than, the gas supply or injector tube, and is located between a pair of discs or other suitable members; the arrangement being such that the gas is compelled to pass between the coils of the spring on its way to the injector nozzle. Suitable externally-operated means are provided to move the discs or other members relatively towards or away from each other, in order more or less to close or open the coils of the spring, and thereby regulate the gas passing to the mixing chamber of the burner. A plug carried by one end of the injector tube has a passage communicating with the interior of the coiled spring, one end of which is carried and positioned by the plug, while the other end is carried and closed by a non-rotatable member abutting against a perforated end cap or injector nozzle carried by the other end of the injector tube. This non-rotatable member is fluted or cut away to permit the gas to pass to the injector nozzle; the coils of the spring being opened or closed by adjusting the plug and/or the end cap or injector nozzle.

Water Joint for Geysers.—No. 223,483.

BARRALET, J. H., and NEW GEYSERS, LTD., both of London.

No. 5482; March 3, 1924.

This invention relates to geysers having inner and outer annular water chambers, and has for its object to provide means connecting together these water chambers in a manner permitting water to flow freely from the outer to the inner chamber when the geyser is in operation, and rendering the removal of the inner chamber from the outer chamber for repair and like purposes a comparatively easy matter. In carrying out this invention use is made of a water joint of a type known in connection with steam generators, radiators, and other heat exchangers, and comprising an open-ended cylindrical body with radial water passages, and a joint making seating at its open end. A facing ring for co-operation with the seating has a transverse bridge piece, and screw clamping means passing axially through the body and into the bridge piece. The body portion of the joint is built into the outer water chamber, so that the radial passages open to the water space between the walls of the chamber and the facing ring are secured to the outer wall of the inner water chamber so that the two chambers can be connected and joined by a single screw inserted from outside the geyser. The jointing members are preferably affixed to the inner and outer wall chambers at points diametrically opposite the usual outflow nozzle of the geyser; and the joint and the nozzle may co-operate in supporting the inner chamber within the geyser.



Water Joint for Geysers.

The drawing is a vertical section of a portion of a geyser fitted with the joint described.

Gas Burner.—No. 223,484.

GIHON, W., and NODDINGS, H. S., of Massachusetts.

No. 5557; March 4, 1924.

According to this invention the gas and air are admitted directly into the burner head, and a hollow slotted breaker or mixer is supported within the burner head in a position transverse to the direction in which the gas and air flow through the head, to break-up the gas and air currents and thoroughly to mix the gas and air. The object is to produce a burner which gives an intense blue flame, and which is well adapted for use in steam boilers and other heating apparatus for houses and buildings.

Manufacture of Fuel.—No. 223,624.

ILLINGWORTH S. R., of Radyr, and ILLINGWORTH CARBONIZATION COMPANY, LTD., of Manchester.

No. 13,648; May 23, 1923. No. 27,047; Oct. 29, 1923.

This invention relates to apparatus to be used in the manufacture of carbonized fuel, particularly shaped, produced by the carbonization of coal suitably pre-heated, or blends of coal or coals which are suitable without treatment, and do not expand during carbonization.

The apparatus comprises a brickwork retort having in it a number of heat-conducting plates of iron extending across the retort. The plates are preferably of H section, in which case flues are arranged at the ends of the plates, or the plates may have enlarged ends which enter recesses in the brickwork. The arrangement of the plates is preferably such that there is formed a brick retort setting containing a number of tapering retorts that are less than 7 in. but greater than 2 in. in width, and in which the taper is not less than $\frac{1}{16}$ in. per ft. of height. Above the retort setting is a storage hopper for supplying coal into a number of measuring chambers, which are closed at the bottom by a sliding door. Leading from each measuring chamber is a pipe upon which slides another pipe of such diameter that it can enter a mould in the retort. The sliding pipes act as guides for the coal from the inner pipes to the moulds, and also as ejectors of the carbonized fuel from the moulds or retorts. Or pipes may be secured to the measuring chambers which can be raised or lowered relatively to the storage hoppers.

The retorts are provided with doors; and arranged below the retorts are brick or cast-iron chambers which may be used either as cooling chambers for the products falling from the retorts when the doors are opened, or for the further carbonization of these products. In the first case, flues surrounding the chambers are employed for the circulation of air or gas, which is led to the flues which surround the retorts, and in which combustion takes place. In the second case combustion takes place in the flues surrounding the chambers; the hot gases passing to the flues surrounding the retorts. A number of horizontal passages lead from these flues to spaces surrounding the retorts.

In the above arrangements the chambers below the retorts or the lower part of the furnace may be used as a gas producer; the hot gases therefrom being led to the flues surrounding the cast-iron retorts. Such flues may consist solely of a space between the iron retorts and the walls of the producer. The gases, after being cooled by heating the retorts, may be mixed with the gases produced in the retorts; the amount of gas generated being regulated by the amount of air supplied. By means of such an arrangement the burners usually situated at the bottom of the furnace can be dispensed with. The amount of gas generated is so adjusted that sufficient heat is supplied to the retorts to carbonize the coal therein. The carbonized coal, which passes downwards into the lower half of the producer (and which is not required for the generation of gas) can be withdrawn from the producer from time to time, and utilized for smokeless fuel or coke. Small coal unsuitable for producer work is thus utilized in a producer, or converted into smokeless fuel.

Carbonization of Shale, Coal, &c.—No. 223,652.

GUY-PELL, W., of London.

No. 19,016; July 24, 1924.

This invention consists of a vertical heating chamber for treating shale, coal, &c. The material to be dealt with is subdivided by being passed through a plurality of ducts of such form that the distance between any two walls of the ducts is small. The ducts extend throughout the whole of the heating zone, being free to expand and contract either individually or collectively, and having constricted material entrances to avoid choking. The object of the construction is to overcome the low conductivity of the carbonaceous material, which may be intermittently fed into the dome or cover of the apparatus so that it gravitates through the ducts.

Recording Instruments.—No. 223,671.

SIMMANCE, J. F., ABADY, J., and WOOD, F., all of London.

No. 19,496; July 30, 1923.

This invention relates to instruments for automatically indicating and recording the result of a series of analyses of a gaseous mixture. In this type of instrument, successive samples of a gas mixture such as furnace gases are periodically collected, treated with a reagent which absorbs the constituent sought, and transferred to a small gas-holder, in which the diminution in the original volume of the sample due to the action of the reagent is shown by the variation in height to which the bell of the holder rises, as compared with an arbitrarily selected height or "zero" which has been previously determined by a similar operation conducted on a sample of air or gas not containing a constituent capable of being absorbed by the reagent employed. A complete cycle of operations is performed periodically by the action of a small stream of water or other liquid flowing into a vessel fitted with a discharge syphon. The result of each analysis—*i.e.*, the height to which the bell rises—is then recorded on a chart by a swinging pen-arm, with which the crown of the bell engages at some selected point before reaching its full height, usually the 20 p.ct. mark, the pen normally remaining at this point and only moving from it towards zero by the action of the rising bell at the completion of the analysis, when it again returns to this point as the bell returns into the tank and expels the sample, and the cycle of operations is completed. In connection with other types of gas analysis apparatus, it has, however, been proposed to provide a brake for the indicating and recording element which is arranged to be released only upon or prior to the completion of the measuring operation, so as to retain this element in a position corresponding to the last analysis during the inter-

vals between successive analyses. According to the present invention, apparatus of the kind above referred to, comprising a vessel fitted with a discharge syphon, is provided with a brake adapted to be released by the rise of the water or other liquid in the vessel for the same purpose.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 19.]

Nos. 26,733-27,365.

ALDHAM, E. H.—"Geysers." No. 27,100.
ASKANIA-WERKE AKT.-GES. VORM CENTRAL-WERKSTATT DESSAU UND C. BAMBERG-FRIEDENAU.—"Process for regulating withdrawal of gas from retorts or furnaces." No. 26,805.
BARRALET, J. H.—"Geysers." No. 27,113.
BRUTZKUS, M.—"Process for obtaining water gas from liquid hydrocarbons." No. 26,786.
FOSTER, C. E.—"Radiation pyrometers." No. 27,335.
GERARD, C.—"Gas generators." No. 27,277.
HERTEL, O. H.—"Distillation of carbonaceous material." No. 27,170.
JOHNSON, J. Y.—"Gas producers." No. 27,238.
NEW GEYSERS, LTD.—See Barralet, J. H. No. 27,113.
SALERNI, E. M.—"Apparatus for removing dust from gases, &c." No. 26,826.
SALERNI, E. M.—"Condensers." No. 26,836.
SALERNI, E. M.—"Distillation of carbonaceous materials." No. 27,284.
TROMELIN, O.—"Lighting apparatus." No. 27,176.
UNION APPARATEBAU GES.—"Gas density recording device." No. 26,820.
WELLER, F. W.—"Apparatus for regulating flow of gases." No. 27,151.
WHITFIELD, C.—"Gasification of fuel in steam-boiler furnaces." No. 27,212.
WOOD, W.—See Johnson, J. Y. No. 27,238.
WUNSCH, G.—See Askania-Werke Akt.-Ges. vorm. Central-werkstatt Dessau und C. Bamberg-Friedenau. No. 26,805.

[Extracted from the "Official List" for Nov. 26.]

Nos. 27,366 to 28,036.

BOYER, J. F.—"Toasters and grillers." No. 27,877.
DEMPSTER, R. & J., LTD.—"Disc valves for gas-tight joints." No. 27,637.
HELPS, G.—"Gas manufacture." No. 27,373.
HILL, W.—See Dempster, R. & J., Ltd. No. 27,637.
MOON, P. G. G.—See Boyer, J. F. No. 27,877.
RUDE, J.—"Gasifying oil in water-gas production, &c." No. 27,894.
SMITH, C. R.—"Inverted gas mantle." No. 27,522.
SUIDA, H.—"Process for obtaining gases rich in ethylene." No. 28,027.
TERRELL, T.—"Manufacture of incandescent gas mantles." No. 27,953.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN OF BILLS (SESSION 1925) RELATING TO GAS UNDERTAKINGS.

Barrow-in-Furness Corporation.—In an Omnibus Bill, the Corporation will seek the enactment of further provisions with regard to their water, gas, and electricity undertakings, and the supply of water, gas, and electricity by them, including provisions as to the sale of fittings, &c., and charges for (among other things) stand-by supplies.

Bexhill Corporation.—The Corporation are seeking powers, by Bill, to purchase by agreement or compulsorily the undertaking of the Bexhill Water and Gas Company, and to supply gas and water within the Company's limits.

Bedwellty Urban District Council.—Among other provisions in a Bill to be promoted by the Council will be one to empower the Council to sell, and the Rhymney and Aber Gas Company to purchase, the whole or any part of the mains, pipes, and other apparatus used by the Council for the supply of gas in such part of the Rhymney Valley within the urban district of Gellygaer as is situate between the Abertysswg Brook on the north and Cefn Brithdir Colliery Pit on the south, and to provide that after such sale and purchase that part of the urban district of Gellygaer shall be included within the limits of supply of the Rhymney and Aber Gas Company, and shall cease to be within the gas limits of the Council.

Blackpool Corporation.—A Bill to be promoted by the Corporation will contain, *inter alia*, further provisions in reference to the gas and electricity undertakings of the Corporation.

Bolton Corporation.—Included in an Omnibus Bill will be clauses to confer further powers on the Corporation with reference to their gas undertaking.

Burnley Corporation.—Application is intended to be made by the Corporation for a Bill which, among other matters, will contain clauses with regard to their gas undertaking, including provisions for the establishment of a station for testing gas meters, stand-by charges, damage to gas lamps, and the purchase, working-up, and sale of residual products. Other clauses will deal with the alteration of the boundary of the parish or township of Burnley, so as to include areas described for the purposes of the supply of gas, water, and electricity, &c., and for the purchase of any existing gas, water, or electricity works therein. The area named includes a portion of the urban district of Padiham.

Gas Light and Coke Company.—A Bill to be promoted by the Company is for the purpose of providing for the transfer to them of the undertaking of the Brentford Gas Company; to authorize them to make a new street at Nine Elms; to acquire land compulsorily in Westminster abutting on Monck Street; to deal with certain specified rights of way; to confer upon them power to erect and use gasworks, &c., on stated lands; to increase the remuneration of Directors and Auditors; to deal with bonds and debentures; to enact new provisions as to the issue of capital by auction or tender; to authorize the Company to supply power gas by agreement, &c. It is desired to extend and apply the enactments of the Gas Light and Coke Company to the district now supplied by the Brentford Company, and to repeal (with certain exceptions) the enactments relating to the Brentford Company, including certain restrictions upon the rights of that Company with reference to the use of lands for the manufacture of gas and to the purchase of and dealing with and in or the manufacture of residual products and other materials; to authorize the Gas Light and Coke Company to exercise the unexercised powers of the Brentford Company of raising money by the issue of capital or by borrowing; to make provisions as to the Directors, Auditors, and officers of the Brentford Company, and for the taking over or payment of compensation to such officers; and to authorize the charging by the Gas Light and Coke Company of a higher price or prices for gas in the area now supplied by the Brentford Company than in the area now supplied by the Gas Light and Coke Company.

Horley District Gas Company.—Particulars were given on p. 302 of the "JOURNAL" for Oct. 29 of the Company's scheme to erect a generating station and works on their land and to supply electricity within a defined area.

Hoylake and West Kirby Urban District Council.—One object of a Bill to be promoted by the Council is to empower them to acquire the undertaking of the Hoylake and West Kirby Gas and Water Company.

Mansfield Corporation.—A General Bill of the Corporation will include further provisions with regard to their gas and electricity undertakings.

Oldham Corporation.—Among the objects of a General Bill of which the Corporation have given notice is to confer upon them further powers in connection with their gas, water, and electricity undertakings—including the authorization of the supply of power gas.

Rochdale Corporation.—A General Bill to be promoted by the Corporation will contain provisions conferring upon them further powers in connection with their gas, water, and electricity undertakings.

South Metropolitan Gas Company.—The Company give notice of their intention to introduce a Bill to authorize agreements or arrangements between them and other gas companies for the use of, or participation in the use of, or in any advantages obtainable from, premises, plant, organizations, operations, or other facilities belonging to, enjoyed, carried on, or provided wholly or partly by, the Company in relation to the manufacture and sale of gas and products arising in such manufacture, or with reference to the provision of such facilities, or of moneys, for the purposes of any such agreement, and to make provision as to supplies of gas in bulk. To provide for the satisfaction of any consideration payable by any such other company under any such agreement by shares, stock, or securities; to empower the Company to take over or acquire, or exchange, stocks or securities for, shares, stock, or securities of, or to lend money to, or to acquire interests in, any such other company or any other company carrying on business as a gas company, and to apply moneys, or issue stocks or securities for such purposes. To confer powers on the Directors of the Company, to provide for joint committees of the Company and other companies, and for representatives of such other companies becoming Directors of, or otherwise associated with, the Company, and for their remuneration and to vary the number or qualifications of Directors of the Company. To provide for compensation to Directors or officials retiring or officials suffering loss on any amalgamation or purchase mentioned in section 37 of the South Metropolitan Gas Act, 1920.

Stockton-on-Tees Corporation.—The Corporation intend to promote a Bill to empower them to acquire the undertaking of the Haverton Hill-on-Tees Gas Company, Ltd.; and to confer further powers on them with regard to their gas undertaking.

Uckfield Gas Company, Ltd.—A Bill of which notice has been given is for the dissolution of the Company and the incorporation of a new Company for supplying gas and electricity within scheduled limits.

Wallasey Corporation.—Various powers are sought by the Corporation, and among these the Bill to be promoted by them will contain clauses to extend the area of the Corporation for the supply of gas, water, and electricity so as to include the township or parish of Moreton and part of the township or parish of Bidston-cum-Ford, and to repeal the powers of the Hoylake and West Kirby Gas and Water Company in relation to that township and part of a township on such conditions as may be specified in the Bill. There will also be other provisions relating to these Corporation Departments.

Walsall Corporation.—The Corporation will propose, in a General Bill, provisions with regard to the lighting of private streets.

PROVISIONAL ORDER.

Bexhill Water and Gas Company.—Notice is given by the Company of their intention to apply to the Ministry of Health for a Provisional Order under the Gas and Water Works Facilities Act, 1870, to authorize certain water works, the establishment of a renewal fund, and the holding of annual meetings. Among other administrative powers, the Company seek to make provision as to Directors contracting with the Company, and to secure that a Director shall not be disqualified by reason thereof under such circumstances as may be prescribed by the intended Order.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

There have appeared in the "London Gazette" the following further notices regarding applications to the Board of Trade under the Gas Regulation Act.

DECLARATION OF CALORIFIC VALUE.

Aldershot Gas, Water, and District Lighting Company.—525 B.Th.U. in substitution for 500 B.Th.U. (Lady Day, 1925.)

SPECIAL ORDER.

Haverfordwest Corporation.

The Corporation are applying for an Order under section 10 to empower them to utilize for gas purposes scheduled land, to extend the limits of supply, to confer general powers upon them in regard to their gas undertaking, and to enable them to borrow further money.

VALUATION OF GAS-WORKS.

Reduction of Assessments.

Two important appeals against the assessments placed on the properties of gas undertakings were disposed of last week. In the first case, Berkhampsted Gas Company appealed against an assessment of £4372 gross estimated rental and £2019 net rateable value; the figures being reduced to £3303 gross estimated rental, and £950—a reduction of 53 p.ct. in the net rateable value. In the second case, that of the Tring Gas Light and Coke Company, Ltd., the assessment appealed against was £1133 gross estimated rental, and £853 net rateable value. This assessment was reduced to £800 gross estimated rental and £425 net rateable value; the substantial reduction of 50 p.ct. being obtained in this case. The appeals had been going on for the last twelve months; the valuers advising the Rating Authorities being Sir Trustram Eve and Mr. W. G. Cooke, and the Valuer employed by the Gas Companies Mr. E. Howard Collins, of 45, Parliament Street, Westminster. The above information shows the importance of gas companies giving adequate attention to the question.

WELFARE OF EMPLOYEES OF THE NEWCASTLE GAS COMPANY.

Pension and Widows' and Orphans' Funds.

On Jan. 1 of this year the Newcastle and Gateshead Gas Company introduced pension and widows' and orphans' funds on novel lines, the outstanding feature of which is the death benefit. The Directors and officials, on examining various pension schemes, came to the conclusion that in most cases the benefit where death occurs before the member reaches pension age was totally inadequate. They formed the opinion, which was confirmed by the employees, that it is a greater anxiety to a married man that he may die before pension age, and leave a wife and family with little or no provision, than that he may not be able to work or not be provided for in old age. In respect of a wage earner with twenty or more years' service dying, and leaving a widow and/or child under sixteen years of age, a payment of £300 is made, and £15 less for each year's service less than twenty years. In the case of members of the staff, the benefit is equivalent to three years' average final salary.

The Directors also provided in the scheme a profit-sharing element, inasmuch as the amount which the Company contribute to the scheme each half-year, and the rate of pension payable, depend on the rate of dividend paid by the Company to the ordinary shareholders. The Company guarantee a minimum. Four Directors are trustees, and there is a Management Committee, half of the members being elected by the employees and half by the Directors, and the Chairman of the Company is the Chairman of the Committee. The employees contribute on a scale based on age at the date of joining the fund. The funds apply to both workmen and officials, and 98 p.ct. of those eligible have voluntarily joined the fund. Three years' unbroken service is a condition of membership.

The following are sample benefits to wage employees:

Service.		Pension if Average Dividend be 4½ P.Ct. (Pre-War Rate), per Week.
Before Start of Fund.	After Start of Fund.	
		£ s. d.
	40	1 10 0
10	30	1 2 11
35	5	0 13 6
	15	0 8 9
	35	1 3 9

The pension and death benefits of the salaried staff are based on average final salaries. The scheme embraces all old employees, including a large number already over 65 years of age—the future retiring age under the scheme.

The severe storm in the English Channel in the early hours of last Thursday played havoc in Sidmouth. The sea water broke over the sea wall and flooded the town, filling the lower rooms of hotels, houses, and shops to the ceilings in many cases. The fires at the gasworks were extinguished, and caused temporary dislocation.

THE ORIENTAL GAS COMPANY.

The ordinary general meeting of the Company was held at Finsbury House, Blomfield Street, E.C. 2, on Wednesday, Nov. 26. Mr. STANLEY HUNTER JONES (Senior Director) presided, in the absence of the Chairman of the Directors, Mr. Hubert Dynes Ellis, J.P., through illness.

The CHAIRMAN, before proceeding with the business of the meeting, announced, with regret, that their respected Chairman of Directors, Mr. Hubert Dynes Ellis, was unable to be present, as he had been unwell for some weeks and was confined to his house. Though Mr. Ellis's condition had improved, he had not sufficiently recovered to be able to undertake the duties of the Chair. He (the Chairman) believed that this was the first meeting Mr. Ellis had missed in a period of over thirty years, and he knew the keen regret that Mr. Ellis felt at his enforced absence. He was sure the shareholders would join with the Board in the regret they felt at Mr. Ellis's absence, and in wishing him a speedy recovery to normal health.

Moving the adoption of the Directors' report and accounts for the year ended June 30, 1924, the Chairman dealt first with the revenue account. On the debit side there was an expenditure on coals, purification, and wages of £62,601, which exceeded the expenditure in that connection in the previous year by £1134. The amounts expended on salaries, Directors' and Auditors' fees, and Indian income-tax were much the same as previously. The amount spent on mains, services, meters, and fittings was £15,086, which showed a reduction, as compared with the previous year, of £5541. In regard to wear and tear of works, there was an increased expenditure of £3365. This was due practically to having debited the revenue account with an amount very similar to that for capital works, which, of course, might have been properly charged to capital. As to the credit side of the account, the gas revenue showed an increase of £6585, which was very satisfactory. The amount for residual products, at £40,900, showed a reduction, as compared with the previous year, of £8916. This was due to the falling values of coke, and, to some extent, to the lesser quantity of coke produced, resulting from the smaller quantity of coal carbonized. The coal used during the past year was of a superior quality to that carbonized in the preceding year. In the exchange, at £2308, it was gratifying to note that there was an increase of £2293. The balance of profit on the revenue account was £33,397, and this was more, by the small sum of £207, than in the previous year.

DIVIDEND.

Passing to the profit and loss account, the Chairman said that the amount available for distribution—i.e., for dividend purposes—was £45,853, which was more, by £3953, than in the previous year. The Directors proposed to recommend a dividend at the rate of 4½ p.ct., which, coupled with the interim dividend of 3½ p.ct. paid in May last, would make 8 p.ct. for the year, less tax.

WORKING RESULTS.

The Engineer and Manager had reported that the Company's plant had been well maintained during the year under review, and was in good condition. The reconstruction of gasholders had been practically completed, and some additional purifying plant installed. This had meant an increase in the expended capital of £9680; the total expenditure on capital account, as shown by the balance-sheet, being £430,919. The Company's reserve of manufacturing power was most satisfactory. They had installed retort power equal to nearly double the Company's present output of gas; and this, accompanied by their ample storage accommodation of nearly two days' output of gas, placed them in an uncommonly strong position for meeting future increase of business without additional capital outlay under those heads for a long time to come. The working results were very satisfactory, and reflected great credit on the Engineer and Manager, as well as on his staff and workmen. The make of gas per ton of coal of 12,427 c.ft., of the high quality which the Company supplied, compared favourably with the working of gas undertakings in England. There had been an increase in the make of gas per ton of 14·88 p.ct., and an increase in the gas accounted for per ton of 15·21 p.ct. The quality and purity of the gas had been well maintained throughout the year, and there had been no case of deficiency found against them by the Corporation at Calcutta. This, the Chairman considered, was a very high tribute to the good working of the undertaking.

DISTRIBUTION DEPARTMENT.

In the distribution department there had been no large expenditure in regard to extensions of mains. Comparatively little of this sort had been necessary, owing to the expenditure incurred previously; and the distribution system had been well maintained. He had heard recently from a friend, home from India, that he had not come across a better lighted city than Calcutta. For the information of the shareholders, the Chairman said it required over 17,000 lamps, which were supplied by the Company, to light the city. There had been a very gratifying increase in the number of gas stoves, geysers, and appliances fitted during the year; this increase being 1057. The Company had very energetic district officers and staff. He had had the pleasure of seeing three of them, home on leave, and he had been greatly impressed by the story they had told him as to how things were going in India. Of course, there had been troubles there; but he was happy to say that the Company's operations had been carried on throughout the year without interruption. There had been attempts to have what the Indians called "hartals," and stoppages of work; but the Company had come through extremely well. The year had been an uneventful one, as he hoped might always be the case.

In conclusion, the Chairman expressed the indebtedness of the Company to the white staff in India, numbering eight all told. They handled hundreds of workmen, of different creed and different colour; and it was a tremendous tribute to them that they dealt with the

workers as well as they did, and that the work ran so smoothly and gave such good results.

Mr. BERTRAM W. ELLIS seconded the adoption of the report and accounts.

Mr. E. J. WOOLLEY (a shareholder) congratulated the Board on a record year. There was no doubt that they could attribute the present state of affairs very largely to the management in the past, and to the able guidance of the destinies of the Company by Mr. Hubert Dynes Ellis for the last thirty years. It was with such feelings that the shareholders would like to send a message to Mr. Ellis, expressing their sympathy with him in his illness, and wishing him a speedy recovery. With regard to the balance-sheet, Mr. Woolley pointed to the expenditure on capital account, £430,919, and mentioned that, on the other side of the account, there was a bank loan of nearly £64,000. He suggested that perhaps the time had come when this £64,000 might be made a permanent feature by an addition to the capital. The Company had progressed favourably, and it would be bringing the assets more into line with the liabilities if the capital were increased by the amount of the bank loan. They were paying £3000 in interest on the loan, and it would not take very much more to increase the capital and pay 8 p.ct. dividend on it.

Mr. G. CAVE ORME (a shareholder), after supporting Mr. Woolley's remarks with regard to Mr. Ellis, also agreed with regard to the bank loan. He had noticed it on the balance-sheet, and was not altogether satisfied about it. He wished to ask questions, not in any hostile spirit, but because he considered that shareholders sometimes were not given sufficient information on the published balance-sheet. In going through the revenue account, the Chairman had omitted to say anything about the large sum of £6400 which was put down as general expenses. This was more than equivalent to a dividend of 2 p.ct. on the capital of the Company, and the shareholders ought to know why such a large sum was given as general expenses. He remembered the time when the Company had always paid 10 p.ct.; but they had never had more than 8 per cent. for over 30 years. Referring to the capitalizing of the bank loan, Mr. Cave Orme pointed out that the capital expenditure was nearly £431,000, and the paid-up capital was £300,000, so that £131,000 was expended on capital account without raising capital. This was provided by a loan from the bank of £64,000, and the use, apparently, of the depreciation account, amounting to £50,000, and the renewals suspense account of £12,000. Surely the time had come when the Company might borrow or increase its capital, in order to regularize the position, and he suggested that the Directors might consider that. After paying a dividend of 8 p.ct. on the capital, they would have £21,800 left, and they had £19,000 invested. He supposed that, as a matter of fact, they would not have much actual cash in hand after paying the dividend; but they were carrying forward no less than £21,800 with which to start the new financial year. The reserve fund was only £6000. It seemed to him that they might almost hope to return to the 10 p.ct. basis again. He noticed that the exchange had helped during the year to the extent of £2300, but this could never be relied upon.

Mr. J. H. MACKAY (a shareholder) said that at the last meeting reference had been made to works which it was proposed to carry out, but nothing had been said on the present occasion as to whether this work had been completed. Also, the Chairman might have said what it was proposed to expend on further works during the current year, because this would also affect the dividend. Then there was an item in the accounts, which he had thought had disappeared from all company balance-sheets—namely, Corporations tax. They paid, first of all, the Indian trading tax, then the British income-tax on the whole profits of the Company, then Corporations tax—he supposed for the last time this year—and, in addition, the poor shareholders were mulcted to the extent of 4s. 6d. in the £, and, if they were unfortunate enough to have to pay super-tax, there was a further addition. As to the capitalization of the bank loan, it seemed to him that if they could borrow from the bank at 4 p.ct. it would be better to do this than to issue further capital and pay 8 p.ct. It was all very well to secure an 8 p.ct. investment; but to create an 8 p.ct. investment out of the earnings of the Company did not commend itself to him in the way it did to Mr. Woolley.

The CHAIRMAN, dealing with the capitalization of the bank loan, said that Mr. Ellis had always been very strongly against this. He had always said that he never wanted to see any more capital issued if he could help it. Mr. Mackay had hit the nail on the head when he had said that it was cheaper to borrow from the bank than to raise further capital. The Company borrowed at 5 p.ct. from the Midland Bank, who were very generous indeed. He himself, as a professional man, was dead against loading a concern with a penny more permanent capital than he could help. It was true that the Company could carry it; but when he saw in the Manager's report that the issued capital per 1000 c.ft. of gas produced had been coming down gradually, it relieved his mind enormously, because with overseas companies there were always risks. It was best to have the capital as low as possible, consistently with what was reasonable, having regard to the possibilities of bad times; though, speaking as a shareholder, he agreed that it would be very nice to have some more capital in a company, paying 8 p.ct. But from the standpoint of those who had to study the inner working of the Company, it was best not to raise more capital, if it could be avoided. As to the amount for general expenses, the Chairman gave details as to how this was made up, and expressed the opinion that the various charges were reasonable in an undertaking of the scale of the Oriental Gas Company. He had not commented on them in his opening remarks, because they were very much as usual. Dealing with the carry-forward of £21,800, he said it would be found, by comparison with previous accounts, that there was generally a carry-forward of much the same amount; and he considered that the reserve was not unreasonable for possible contingencies. He personally would be sorry to see a very small balance carried forward. He was interested in some twenty or thirty gas undertakings, and they all tried to show a comfortable balance to carry on with. Nobody would appreciate an increased dividend more than would the members of the Board; and he hoped that some day conditions would allow them to get back to the dividend they had paid previously, free of tax; but, of course, they did not wish to make any promises in this connection. With regard to works, the gasholder repairs were practically completed. They were engaged at the present time in reconstructing purifiers; and when this was done—it would involve the expenditure of a few thousand pounds—he did not know of any works expenditure of a serious nature which had to be incurred. He did not see why, in the near future, there should not be a reduction in the bank loan. They wanted to cheapen the price of gas, of course, and to have everything in perfect order in India first; but the position was a very hopeful one, and they did not anticipate any very serious capital expenditure for some little time to come. It was the desire of the Board to write-down the bank loan; but, owing to the fact that the work had been held up during the war, the plant had needed overhauling. At present they had a first-rate undertaking. Mr. Snelgrove, the Manager, had budgeted for what he wanted, and the Company had given it to him and paid the bill. As to Corporations Profits Tax, this was coming to an end, and he believed this was the last occasion on which it would be seen on the accounts.

The SECRETARY (Mr. S. Rainer) said there would be a small amount next year. Asked what it amounted to last year, he said it was £1475.

The report and accounts were adopted.

On the motion of Mr. BERTRAM W. ELLIS, seconded by Mr. H. H. MCLEOD, a final dividend at the rate of 4½ p.ct., less tax, was declared.

On the proposition of the CHAIRMAN, seconded by Mr. H. H. MCLEOD, Mr. Bertram W. Ellis and Mr. B. M. Gill were re-elected Directors.

Mr. BERTRAM W. ELLIS, in returning thanks on behalf of himself and Mr. Gill, assured the meeting that they hoped to deserve the continuance of the shareholders' confidence in them.

On the motion of Mr. MACKAY, seconded by Mr. WOOLLEY, Messrs. S. W. Savage and F. J. Bradfield were re-elected Auditors, at the same remuneration as previously.

Mr. BRADFIELD, on behalf of himself and Mr. Savage, returned thanks.

Mr. BERTRAM W. ELLIS then proposed a vote of thanks to the Manager, Secretary, and staff generally. It would be gathered, he said, from the report and accounts, and from the Chairman's remarks, that the record of faithful service by their servants in Calcutta had been maintained throughout the year. Mr. Snelgrove and his assistants had had a very hot and trying year to contend with, but they had come through successfully. Supplementing the Chairman's remarks as to the working of the undertaking, Mr. Ellis said that the leakage of gas on the district had been reduced fractionally again this year, and this was to the credit of the men in Calcutta. In addition to there having been no complaints from the Corporation as to failure of pressure, the complaints with regard to defects in lighting had been remedied so promptly that there had not been a single deduction from the Company's bills on the part of the Corporation. This, again, was greatly to the credit of the men in India. Four of the men had been on leave during the year, and had all renewed their agreements with the Company, a testimony both of the Company's appreciation of their character and work, and also of their satisfaction of the Company's treatment. As to the London staff, Mr. Rainer and his assistants had carried on their work with that care and vigilance which had characterized their efforts ever since he had had anything to do with the Company.

Mr. B. M. GILL seconded the resolution, which was carried with acclamation.

Mr. RAINER, in a brief reply, expressed his appreciation of the vote of thanks, which he would have pleasure in conveying to Mr. Snelgrove and his fellow workers; they deserved it a good deal more than the staff in London, in view of the trying conditions under which they had carried on.

On the motion of Mr. CAVE ORME, seconded by Mr. H. S. WHILE, a vote of thanks was accorded the Board for their successful conduct of the business, and to Mr. Jones for having presided at the meeting.

Mr. JONES suitably replied, and the meeting closed.

The Lyons Fair.—The next Lyons Fair will be held from March 2 to 15, 1925, and will contain exhibits from upwards of twenty different countries. The Fair was attended by over 3000 exhibitors this year, and it is expected that this number will be exceeded in 1925. It is proposed to organize parties desirous of visiting; and arrangements are being made for transport, accommodation, &c.

Newcastle Gas Company's Exhibit.—At a town-planning exhibition now being held at the Armstrong College, Newcastle, the Newcastle-upon-Tyne and Gateshead Gas Company have an interesting exhibit which demonstrates that the annual soot-fall on the city is 6700 tons, which, it is explained, would load up a line of carts extending from Newcastle to Hexham—a distance of over twenty miles. The purpose of this attractive display is to impress on the visitors that there is a smokeless alternative in gas and gas coke.

Churnet Valley Gas Company, Ltd.—The tenth ordinary general meeting of the Company was held on Nov. 28, when the Directors submitted the report and statement of accounts for the year ended Sept. 30. The revenue account showed a profit of £1710, and to this was added £750 (the amount at credit at Sept. 30, 1923), making £2461. Against this there was debenture and bank interest amounting to £372, leaving £2089 for disposal. It was proposed to write-off engineering and expenses account, £400, and to pay a dividend for the year at the rate of 5 p.ct. per annum, leaving £914 to be carried forward. Early in the year the Directors offered 6 p.ct. debentures to the shareholders at par, £4600 of which were taken up and paid in full. Out of this sum the old debentures for £2500, which matured on Jan. 23, were paid off, and the balance of £2100 was used for reducing the Company's bank overdraft.

CONTINENTAL UNION GAS COMPANY, LTD.

At the sixtieth ordinary general meeting at Winchester House, Old Broad Street, E.C., next Tuesday (Dec. 9), the Directors will submit the accounts for the financial year to June 30 last, and will present the following report, signed by the Chairman (Col. H. LeRoy-Lewis, C.B., C.M.G., D.S.O.):

It is greatly to be regretted that, in spite of all the efforts of statesmanship, another year has passed in which little actual progress in the re-adjustment of the economic situation on the Continent of Europe can be reported. This continued unsettlement has had an injurious effect on the value of the French franc, upon which the prosperity of this Company chiefly depends. During the year under review the franc reached, at one time, the unprecedented figure of 120 to the pound, and generally remained at a more depreciated value than that of the previous year. The quotations recently have become steadier, and are not now much worse than those prevailing a year ago.

The Directors are pleased to report that the improvement in the gas industry in France has been maintained. This has enabled the Compagnie L'Union des Gaz to increase their rate of dividend from 3 to 5 p.ct. per annum; but it is evident that the present exchange quotations make a very much larger increase of revenue in francs necessary before the sterling value of the return on our large investment in the French Company can be restored to its former amount.

After deducting management expenses and pensions charges, and making provision for income-tax and corporation profits tax, the balance at the credit of profit and loss account at the close of the year, including £1248 brought forward, is £18,890. The Directors have transferred £6000 of this amount to the exchange reserve account, leaving £12,890 to be dealt with. An interim dividend of 3½ p.ct. less income-tax has been paid on the preference stock, and the Directors now recommend the payment of a final dividend of the same amount, making 7 p.ct. for the year. This is the full rate to which the preference stock is entitled in any one year before a distribution can be made on the ordinary stock. This payment will absorb £10,850, leaving a balance of £2040 to be carried forward.

The Directors deeply regret to report the death, which occurred in March last, of their greatly valued colleague, Mr. A. F. Phillips, who had been a Director of the Company for nineteen years. Mr. Stuyvesant Henry LeRoy-Lewis has been appointed to fill the vacancy, and his election is subject to confirmation at the forthcoming annual meeting. The Directors, who retire by rotation, in terms of the Articles of Association, are Sir George Alexander Touche, Bart., and the Rt. Hon. Lord Wargrave, P.C., who, being eligible, offer themselves for re-election. The retiring Auditors (Mr. C. P. Crookenden, F.C.A., and Mr. G. A. Cave-Orme) offer themselves for re-appointment.

TORONTO CONSUMERS' GAS COMPANY.

The annual general meeting of the Company was held in Toronto on Nov. 3—Mr. A. W. AUSTEN (President) in the chair.

The Directors reported that during the year ended Sept. 30 the number of consumers had been increased by 5654. The net earnings for the year were $1,402,540; and after payment of interest, dividends, and plant and buildings renewal fund charges, there remained a surplus of $9855, which has been added to the special surplus account. The Company's manufacturing plant, distribution system, and equipment have been maintained in good condition, $642,604 having been expended on repairs and renewals during the year. To meet the constantly increasing demand for gas, and to ensure a uniform and adequate supply throughout the territory served by the Company, a comprehensive programme of extensions to the trunk mains system has been planned. While good progress has been made with these extensions, it will take about three years to complete the work. The new mains have been planned with a view to adopting a medium high pressure system of distribution, by which the Company will be able to extend the area of supply to the more thickly populated districts surrounding the City of Toronto now without gas service. In this connection the Company have acquired a suitable site for the location of a district gasholder.

The following statement for the past year, as compared with the preceding one, shows:

	Meters.	Gas Sales.
Year ended Sept. 30, 1924	142,836 ...	5,152,129*
Year ended Sept. 30, 1923	137,182 ...	5,392,860

* Price of gas reduced on April 11.

The PRESIDENT mentioned that the Company were sending out nearly 50 p.ct. more gas now than was used in 1915; and with nearly 143,000 customers, it seemed probable that as soon as street mains could be laid into the new territory, another 10,000 consumers could be taken on. The increase in gas sales was accounted for by the greater use of gas per capita of population. The volume of gas sold per annum per unit of population in 1915 was 6888 c.ft.; in 1924 this figure had increased to 8708 c.ft.

Mr. ARTHUR HEWITT (the General Manager) pointed out that for many uses the cost of gas was lower than that of any substitute fuel. In many manufacturing operations, though the fuel cost was greater with gas, its use allowed of radical changes in machinery and processes, which so greatly reduced labour charges and spoilage that the net costs were considerably lessened. In his judgment the demand for gas for industrial purposes would increase very rapidly during the next few years.

Neath Gas Profits.—Mr. Philip Thomas, presenting the minutes of the Neath Gas Committee to the Town Council, said that the gross profit on the gas undertaking for the year was £3834, the net profit being £968. On Sept. 30, 1923, the net debit balance carried forward was £6424. This had been reduced by Sept. 30 last to £3169.

LEARNED SOCIETIES AND SMOKE ABATEMENT.

A Joint Meeting of the Associated Learned Societies of Liverpool and District was held in the Lecture Hall of the Central Technical School on Friday, Nov. 21, to consider the question of "The Smoke Nuisance and its Abatement." Dr. WILLIAM HENRY BROAD, the President of the Liverpool Literary and Philosophical Society, presided; and four interesting papers were read dealing with this subject from different points of view.

The CHAIRMAN said the subject was peculiarly suitable for a combined meeting, and it was bound to be of interest from the point of view of economics, from the æsthetic point of view, for the chemical and engineering problems involved, and because it was essentially an important subject connected with health.

Mr. A. E. FINDLAY, M.Sc., submitted a paper dealing with the chemistry of the subject, and carried out many practical experiments concerned with the important matter of combustion. He said the mechanism of combustion was far from being understood by either chemists or engineers, who regarded it more from the standpoint of the initial and final products, and the energy obtained. He submitted equations for the combustion of carbon, showing the changes taking place on interaction, and drew the conclusion that, if this was so complicated with a simple agent, it must be very much more complicated in the case of compounds such as anthracene. He explained the conditions for slow, rapid, spontaneous explosive, and incomplete combustion, and demonstrated the varying temperatures of ignition of different substances. In the case of coal, incomplete combustion was due mainly to the tarry materials in the coal being only partially burnt.

Mr. J. C. WALLER, M.A., explained the effect of smoke and soot on vegetable and plant life. All botanists knew that the chief product of combustion, carbonic acid, was the food of plants, but that the products of incomplete combustion, in particular soot, were bad for vegetation. Plants needed air, which they obtained through minute pores in the surface of the leaves and through channels in trunks of trees. Soot choked these ducts, and deprived plants of their necessary air supply. Another essential to plant life was light; and a smoky atmosphere cut off the light. Plants also needed a good soil and sympathetic cultivation, but it was not possible to obtain good soil in the cities, because of the sulphuric acid produced from the domestic fireplaces.

Dr. A. A. MUSSEN, D.P.H., Medical Officer of Health for the City of Liverpool, spoke of the influence of the smoke trouble on public health. Nowadays it was realized that the important element in sunlight was the ultra-violet ray. This ray was very powerful against bacteria. If the sputum from a tubercular patient was exposed to these rays for ten minutes, it was completely sterilized. This showed the enormous power of ultra-violet light over bacterial life; and if sunlight had so beneficent an effect on diseases, it must also be a great preventive. The blood of a body exposed to direct sunlight was profoundly affected, and the constituent antagonistic to bacterial growth was greatly increased. Another disease of darkness was rickets—a disease of the bones, which at one time was supposed to be due to insufficiency of food. Experiment had shown that lack of sunlight played an important part in this disease. Animals could be kept without food for a much longer time if exposed to the ultra-violet rays than if they were confined in darkness. Lack of sunlight accentuated the dangers of poor food. They must continue to aid in the abatement of the smoke nuisance by instructing engineers and stokers in the proper handling of industrial furnaces, and by improving the domestic house by the installation of gas fires and cookers.

Mr. S. GLOVER, M.Inst.C.E., dealt with the subject from the engineering point of view, and touched on the various methods of smoke prevention. His short paper was accompanied by a number of lantern slides showing the microscopic formation of coal and the methods adopted in large Liverpool works for the prevention of smoke. He said the word "smoke" was an inclusive one, as there were many sorts of smoke and many qualities of it; but it was the abatement of the nuisance caused by coal smoke in which they were specially interested. For the cure of the domestic nuisance, they must look to the gas-works. They now produced from 16 million tons of coal 8 million tons of solid smokeless fuel, and many million c.ft. of gaseous fuel. About 1,750,000 gas appliances had been fitted within the boundaries of Greater London; and the same thing obtained wherever there was a real live gas authority. Coal gas was capable of performing, and was actually performing, a great service in reducing the smoke in the atmosphere.

Mr. R. E. GIBSON, M.Inst.C.E., Engineer of the Liverpool Gas Company, in proposing a vote of thanks to the Chairman and the speakers, said it was necessary to arouse the public conscience on this matter. The means whereby smoke could be avoided would be forthcoming if the public of this country were determined that they would have a clear atmosphere.

In the discussion which followed, one of the speakers said the ideal fuel was that which was on tap. Another speaker, the City Analyst, said it was not sufficient to get rid of the smoke by eliminating the carbon; the sulphuric acid also must be eliminated. For five or six months of the year the rainfall as tested in Liverpool was acid, and during a year as much as 1½ lbs. per sq. in. had been deposited. This had a deleterious effect on life, and its effect on the stone of some of their finest buildings was evident to anyone. No amount of efficient firing would get rid of this sulphur. The most effective way was to convert the coal into gas, and use it in the form either of gas, or, by conversion, electricity. Mr. Gibson in this connection pointed out that gas undertakings were compelled to extract the whole of the sulphuretted hydrogen from the gases, and therefore the products of combustion from town gas did not contain any appreciable amount of acid-forming sulphur.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The past week has witnessed a very satisfactory increase in volume of business, though there are still considerable quantities of coal available before any material increase in price is anticipated. A good many collieries have now been able to find themselves in a good position for the first half of December, and the outlook for the rest of the month and for January is improving. Quotations for forward shipment are being advanced by a few pence in many cases.

Good Durham bunkers have been in good demand up to 19s. 6d., and the unscreened coking position looks better, with improved inquiry. This has long been a very weak market, and, if the demand continues to improve, it will probably have a good effect on the whole Durham market.

Good gas coals have remained in fair demand, and steady. Wear Specials quote 22s. 6d. f.o.b., and best qualities about 21s. Seconds are still weak and in plentiful supply at 17s. 9d. to 18s. 3d.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

Relief of stocks at the sidings has facilitated the working of collieries; but the market, while it has broadened somewhat, is unable to absorb full production. High-grade house coals continue in good demand. There is some slight improvement in regard to medium and lower qualities, though the open weather keeps back developments of any great moment in connection with domestic supplies. A rather better feeling exists with reference to industrial fuel. The recent purchases of slacks and smalls by electricity undertakings have brought about a sounder equilibrium. There is no material change in values, but exceptionally low quotations are less frequently met with.

Prospects with regard to coke claim a great deal of attention. It was hoped the contract prices for the New Year would have been settled at a conference which has taken place between representatives of the collieries and of Midland blast-furnaces. No agreement was found possible, however. The coke interests, I understand, were willing to continue terms of the present agreement, which are based on 16s. 9d. for coke with a 20 p.ct. moisture content. Smelters pressed for a reduction, and this the collieries declined to concede. There is dissatisfaction with the scale by which prices are graduated under the new system of payment according to analysis. It is objected that 20 p.ct. of moisture is an excessive standard to take as a starting point.

The market for gas coal remains unaltered.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

Gas coals outside contract are not in great demand in Yorkshire or Lancashire. This applies particularly to unscreened qualities. The majority of consumers find it difficult to carry out obligations entered into some time ago.

The mildness of the weather continues to operate against the demand for household fuel; but it is expected that the position will alter during the next few weeks, and that there may be a rush up to Christmas. This the collieries will be well able to deal with, even in regard to the better-grade qualities.

The anticipated improvement in respect of industrial fuel has not materialized, and it now seems certain that it will be some months before there is an increased demand for this class of coal. Contracts expiring at the end of the year are being renewed at prices considerably lower than those of last year, and they are in excess of some of the figures that are being quoted for current sales for immediate delivery. Generally speaking, the situation is problematical. In Lancashire the cotton trade is beginning to buy more freely.

There is no immediate prospect of an improvement in the export demand, the prices put forward from the nearer Continent being such that would warrant the early closing of some of the smaller collieries. So far there does not appear to be any chance of an alteration until the political situation, as it affects rates of exchange and the working conditions of the German miners, is satisfactorily settled.

Prices at Hull at the week-end were: Bunkers—Yorks., Derbys., and Notts. large screened steam, f.o.b. Humber ports, 17s. 6d. to 21s.; best Yorks. hards, Association, 22s. 9d.; Derby best hards, 23s. to 24s. 6d.; West Yorkshire Hartleys, 18s. 6d. to 22s. 6d.; South Yorks. washed doubles, 20s. 3d. to 20s. 6d.; South Yorks. washed singles, 19s.; dry doubles, 14s. 3d. to 16s.; South Yorkshire washed smalls, 14s. 9d. to 15s.; Derby slack, 1 in., 9s. 6d.; South Yorks. rough slack, 10s. 3d. to 10s. 6d.; gas coke, 30s. to 33s.; foundry furnace coke, 21s. 9d.; washed smithy peas, 23s. to 23s. 6d.; washed steam thirds, 19s.; South Yorks. washed trebles, 21s. 6d.

A Piece of Coal and What It Contains.—Mr. Thos. Newton, of the Hereford Gas Department, gave an interesting lecture on the 26th ult. to the members of the local Boy Scout Association, the subject being "A Piece of Coal and What It Contains." The lecturer enumerated the products which are obtained when a piece of coal is heated to a given temperature in a retort. He then referred to the ordinary coal fire, and asked them to consider the great waste which was incurred in allowing so many useful products to escape up the chimney. Fogs, he stated, could be largely prevented by utilizing smokeless fuel, such as gas and coke. Mr. Newton traced the passage of gas from the retorts to the consumers' burners, and incidentally explained the working of the high-pressure system of reinforcing the gas supply in the outlying districts. The scouts were then instructed how to adjust burners so as to get the best results—a feature which was much appreciated.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 1.

More interest is being displayed in the pitch market, and a certain amount of business is reported. The price is steady at not below 50s. per ton, at makers' works.

Creosote is in demand, and the price is firm at about 6¼d. per gallon net and naked at makers' works. This is a figure that should prove satisfactory to both sellers and buyers, and ought to result in a steady flow of orders. At present levels there should not be the inducement for buyers to search for substitutes for wood preservation, as is the case when the price of creosote runs up to an abnormal figure.

Solvent naphtha is a rather better market at about 1s. 7d. per gallon for 95-160 quality. Pure toluole is about 1s. 9d. to 1s. 10d. per gallon. Pure benzole is scarce at about 1s. 7d. per gallon.

Tar Products in the Provinces.

Dec. 1.

With reference to the remarks regarding creosote last week, it has been very rightly pointed out to us that only works which are very near to a shipping installation can secure within a penny of the f.o.b. price. With most of them the deduction from the f.o.b. price for the f.o.b. charges, storage charges, carriage, and tank hire is in the neighbourhood of 1½d, while in some instances it is, of course, as high as 1½d. The above remarks apply to ports where the port charges on cargo are nominal; but where the port charges are in the neighbourhood of 2s. to 3s. a ton, these alone mean ½d. to $\frac{7}{16}$d. per gallon.

The steadiness in the market for tar products which has been obvious during the past few weeks has been maintained, and the general tone is better all round. There has been a further improvement in the market for pitch. Business has been done for prompt delivery at 47s. 6d. to 52s. 6d. per ton, while for January-April 55s. is reported to have been paid, and in one special instance 57s. 6d.

In creosote the improvement in the demand from America continues, and business is reported to have been done at 6¾d. f.o.b.

Water white products are firm. There is still a good demand for benzole, while buyers of solvent naphtha have been endeavouring to cover in their requirements for January-June next year, and as much as 1s. 6d. per gallon delivered to buyers' works in the north for special qualities is reported to have been paid.

Heavy naphtha is still quiet; but sellers believe an improvement in demand will take place before long, and are not inclined to accept less than present quotations, and will not offer very large quantities even at these figures.

Crude carbolic remains very quiet, and makers report that they are still meeting with a considerable amount of German competition at lower prices.

Crude naphthalene is quite neglected, and some business is reported to have been done in pure at as low as £12.

Anthracene quotations are quite nominal, and business is difficult to arrange owing to the very large stocks which are held by consumers.

The average values for gas-works products during last week were: Gas-works coal tar, 31s. to 36s. Pitch, East Coast, 50s. to 52s. 6d. f.o.b. West Coast—Manchester, 46s. 6d. to 47s. 6d.; Liverpool, 48s. to 49s.; Clyde, 50s. to 51s. Benzole 90 p.ct., North, 1s. 4d. to 1s. 5d.; crude 65 p.ct. at 120° C., 9½d. to 10½d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 2d. to 1s. 3d. Toluole, naked, North, 1s. 4d. to 1s. 5d., nominal. Coal tar crude naphtha in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 1s. 4d. to 1s. 6d. Heavy naphtha, North, 1s. 1d. to 1s. 2d. Creosote, in bulk, North, liquid, 5¼d. to 5½d.; salty, 5⅛d. to 5¼d.; Scotland, 5¼d. to 5⅜d. Heavy oils, in bulk, North, 6¾d. to 7d. Carbolic acid, 60 p.ct., 1s. 7d. to 1s. 8d. prompt. Naphthalene, £13 to £15; salts, £4 to £7, bags included. Anthracene, "A" quality, 3½d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

Manchester District Tar Prices.

The average prices realized for the sale of tar in the Manchester district, according to the sliding-scale, for the months of August, September, and October were £2 10s. 0·59d., £2 5s. 4·90d., and £2 2s. 7·86d. respectively.

Gloucester Gas Light Company.—Referring to the announcement inserted in our advertisement columns last week, that this Company wished to raise £20,000 of 5 p.ct. consolidated ordinary (new) stock, we are informed by the Secretary that applications (the lists for which closed at noon yesterday) were received for a total of £40,000. Allotment letters will therefore be sent out in due course for half of the amount asked for by each applicant.

Benzole Mixtures as Motor Spirits.—Due to the decreased production of benzole, the familiar fifty-fifty mixtures are no longer being distributed on the English markets. The National Benzole Company have announced that the percentage has now been reduced from 50 to 40. Other enterprises which have marketed a fifty-fifty mixture have reduced the benzole percentage to 25. While the mixture was an innovation for motorists, and in its early stages of popularity, there was sufficient benzole to go round; latterly—due to the increased demand for the benzole mixture and its reduced production from coke ovens and gas-works—the supply has been considerably less than the demand. Hence the modification in the percentage of benzole now announced.

TRADE NOTES.

Cooper Roller Bearings and Friction Clutch.

The ownership of the Cooper Roller Bearings Company, Ltd., of King's Lynn, has recently changed, and the new proprietors have appointed Mr. C. A. Ablett, M.Inst.C.E., as Managing-Director. The Company are manufacturing the Cooper patent roller bearings and the Cooper patent friction clutch in a large range of standard sizes. Mr. Ablett is also Managing-Director of the Unbreakable Pulley and Millgearing Company, Ltd., of Manchester.

Illustrated Laboratory Catalogue.

The Thermal Syndicate, Ltd., of Wallsend-on-Tyne, have published a new illustrated list of Vitreosil Laboratory ware and apparatus, including the fused quartz or transparent variety of Vitreosil. Several new features have been introduced, and the bibliography has been carefully revised and re-arranged. Among the items of special interest is a mercury condensation pump. With a backing pump giving a vacuum of 0·2 mm., a vacuum of 0·000002 mm. may be readily and quickly obtained. The speed is about 200 c.c. per second. The design is compact; the total length being 25 cm., the diameter of the outside barrel 3·3 cm., and the gas inlet 1·5 cm. The pump, which can be electrically or gas heated, is water-cooled; and a liquid air trap is required to remove the last traces of mercury vapour.

CONTRACTS OPEN.

Turbo Booster.

The Borough of Plymouth require for their gas-works a turbo booster, complete with electric motor, switch panel, &c., by-pass valve, and pressure regulator. [See advertisement on p. 675.]

EXTENSIONS.

Ellesmere Port and Whitby Extensions.

The Gas Committee have made application to the Ministry of Health for formal sanction to the borrowing by the Council of the sums of £2150 for works and plant for a period of 25 years; £10,000 for new mains for a period of 30 years; and £10,000 for new services, meters, stoves, and fittings for a period of 10 years.

Street Lighting at Fulham.—The Fulham Lighting Committee have recommended that an expenditure of £215 be authorized for the conversion of 250 street gas lamps from the present upright system to the superheater type of burner, and that the offer of the Gas Light and Coke Company to carry out the work at a capital cost of 17s. 3d. per lamp be accepted.

Efficient Work of the Sheffield Gas Company.

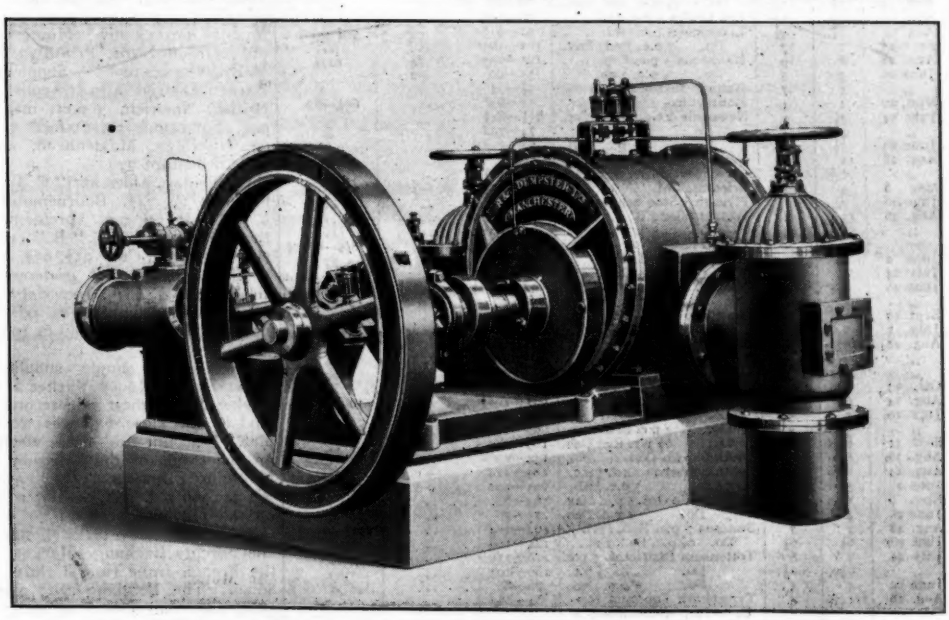
In the early part of this year the adjoining gas undertakings of Handsworth Woodhouse and Dronfield were taken over by the Sheffield Gas Company, and the Company obtained their Order enabling them to carry out the work on Aug. 7. From that date pipes for the mains had to be ordered and specially made, involving the manufacture of 2860 yards of 8-in. lapwelded steel tubes of an average length of 19 ft., and 5940 yards of 6-in. lapwelded steel tubes of an average length of 20 ft. The work of laying these five miles of piping commenced on Sept. 8, and was completed in approximately eleven weeks. Upon this Mr. Ralph Halkett, the General Manager, is to be congratulated. The residents of Dronfield have expressed themselves as astonished at the rapidity with which the work has been completed. The main was connected up last week, and Dronfield were enjoying the same quality gas as that supplied by the Sheffield Gas Company to their 120,000 manufacturing and domestic consumers in the Sheffield area. The laying of the pipe is the first step towards the complete control of the undertaking from Sheffield. By next June it is hoped the transfer will be completed. This is not the only development recently carried out by the Company. The Handsworth Woodhouse area is to be linked up with the Sheffield supply, and they will shortly enjoy the same facilities as have been extended both to Dronfield and Woodhouse. It is of interest to note that the Sheffield Gas Company have now 14 miles of high-pressure mains in the area they supply.

Hoyland Coke Ovens and Bye-Products.—The Hoyland Coke Ovens and Bye-Products Company was registered as a private company on Nov. 24, with a nominal capital of £7500 in 1s. shares, to carry on the business of distillers of coal and coal products, &c. The first Directors are: Sir Samuel Instone, Theodore Instone, Alfred Instone, and Marcus P. Davis.

Gas Explosion at Edinburgh.—On Nov. 21 a series of explosions occurred in the centre of Hanover Street, Edinburgh, as a result of which considerable damage was done to the windows of adjoining property. There had been an escape of gas for some little time in the locality, and when the explosion took place Corporation workmen were actually engaged in opening the ground to search for the leakage.

Weston-super-Mare Preference Stock Issue.—Messrs. A. & W. Richards have been instructed by the Directors to offer for sale by tender £15,000 of 6 p.ct. redeemable preference stock of the Weston-super-Mare Gas Light Company. The minimum price of issue is par, and the stock is to be redeemed at par on Jan. 1, 1935. Sales of gas are growing rapidly, and it is to meet this constantly increasing demand that the capital now being raised is required. Tenders must be sent in to the firm at No. 37, Walbrook, E.C., by 11 o'clock on Thursday, Dec. 11.

ROTARY EXHAUSTERS



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STOCK MARKET REPORT.

DURING the past week the Stock Markets were affected by the sensational happenings in Egypt, but thanks to the Government's prompt and firm action in dealing with the situation, the depression created by the uncertain outlook quickly evaporated. There was a good deal of investment business in gilt-edged stocks, and prices hardened in consequence. Both the War Loan and the 3½ p.ct. Conversion Loan were in good demand. The list of applications for the £6,000,000 Commonwealth of Australia 4½ p.ct. Loan had to be closed much earlier than was advertised, and the net yield—£4 17s. 5d. p.ct.—had the effect of stiffening up quotations of similar existing stocks. Home Rails took a turn for the better, and the debentures are still being purchased, although the supply is somewhat limited. As we anticipated, Industrials, though prices remained firm, were somewhat depressed.

In the Gas Market, investors waiting for stock had their opportunity in the issues of the Wandsworth and the Uxbridge Companies. Both issues were largely over-subscribed, and no tenders at the various minimum prices received allotments. It will be seen by the Table that the Brentford capital stocks both touched 118. This price compares with an average *ex* div. price in July last of 100½; and, in the absence of information with regard to the terms of the proposed amalgamation with the Gas Light and Coke Company and the possibility of standard price revision, the price (to say the least) is a little extreme. An exceptional rise of 7½ points will be noticed in the Maidstone capital stock to 125-135. At the higher average price this stock still realizes over £6 10s. p.ct. per annum calculated on the last two half-years' dividends.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 28.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 14	5	5	Aldershot 5 p.c. max. C. .	80—83	..	81½—82½
235,492	,,	,,	4	4	Do. 4 p.c. Pref. . .	72—77	..	73½—74½
1,551,868	,,	Sept. 25	6	6½	Alliance & Dublin Ord. .	62—67	..	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb. . .	63—68	..	65½
300,000	5	Oct. 23	8	8	Bombay, Ltd.	5—5½	..	..
100,000	10	Aug. 14	8½	8½	Bournemouth 5 p.c. . .	12½—13½	..	12⅝
383,110	10	,,	7	7	Do. B 7 p.c.. .	12½—13	..	12⅝
150,000	10	,,	6	6	Do. Pref. 6 p.c..	10⅝—11⅝	..	11⅜—11⅞
50,000	Stk.	June 26	3	3	Do. 3 p.c. Deb..	57—60	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb..	77—80	..	..
992,043	,,	July 10	6 1/10	6 1/10	Brentford A Con. . . .	114—119	+1	115—118
990,500	,,	,,	6½	6½	Do. B New	114—119	+1	116—118½
76,000	,,	,,	5	5	Do. 5 p.c. Pref. . .	89—94	+2	92—91
306,690	,,	June 12	4	4	Do. 4 p.c. Deb. . .	75—80	..	78—79
181,337	,,	,,	—	6	Do. 6 p.c.Rich.Red.Deb.	100—105	..	..
214,740	,,	Aug. 28	11½	11½	Brighton & Hove Orig. .	170—175	..	..
244,200	,,	,,	8½	8½	Do. A Ord. .	125—128	..	..
1,287,500	,,	July 24	5	5	Bristol 5 p.c. max.. . .	92½—93½*a*	+½	..
855,000	,,	Sept. 25	7	8	British Ord.	115—120	..	116½
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.. .	125—130	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. .	72—77	..	..
100,000	10	May 22	6	8	Cape Town, Ltd. . . .	7—8	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref.. .	6—7	..	..
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.. .	72—77	..	..
626,860	,,	July 24	6	6	Cardiff Con. Ord. . . .	97—100	..	..
237,860	,,	June 26	7½	7½	Do. 7½ p.c. Red. Deb. .	103—106	..	..
157,180	,,	Aug. 14	6¾	5	Chester 5 p.c. Ord. . . .	86—91*b*	..	..
1,513,280	,,	July 24	6	6	Commercial 4 p.c. Cap. .	93—96	..	..
560,000	,,	,,	6	6	Do. 3½ p.c. Cap. .	93—96	..	94½—91½
475,000	,,	June 12	3	3	Do. 3 p.c. Deb. .	58—61	+2	..
800,000	,,	14 Jan. 25	—	—	Continental Union, Ltd. .	37—42	..	37—37½
200,000	,,	June 12	7	7	Do. 7 p.c. Pref. .	89—94	..	92½
660,000	,,	Aug. 28	6½	6½	Croydon sliding scale . .	101—104	..	..
284,975	,,	,,	5	5	Do. max. div. . . .	84—87	..	..
492,270	,,	Aug. 28	9	6	Derby Con.	107—110*c*	..	..
55,000	,,	July 10	4	4	Do. Deb.	74—76*c*	..	..
1,002,180	10	July 24	2	6	European, Ltd.	8—9	..	8½—8⅝
16,503,045	Stk.	Aug. 14	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	95—97	..	95⅛—96⅛
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max. .	61—64	..	62⅜—63⅜
4,082,235	,,	,,	4	4	Do. 4 p.c. Con. Pref. .	79—81	+½	80—80⅝
4,761,930	,,	June 12	3	3	Do. 3 p.c. Con. Deb. .	60—63	..	61½—62 3/10
130,000	,,	—	10	10	Do. 10 p.c. Bonds . .	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb. .	..	..	..
88,300	,,	Sept. 11	6½	6½	Hastings & St. L. 5 p.c. Conv.	95—100	..	99½
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv. .	75—80	..	..
70,000	10	Sept. 25	10	10	Hongkong & China, Ltd. .	16—17	..	..
86,600	Stk.	Aug. 14	10	10	Hornsey 7 p.c.	138—143	..	..
1,976,000	,,	Nov. 20	30	10	Imperial Continental Cap..	172—177*	+1	173—176
263,950	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	70—73	..	..
235,242	,,	Aug. 14	6½	6½	Lea Bridge 5 p.c. Ord.. .	97—102	..	..
2,127,340	,,	Aug. 14	5½	5½	Liverpool 5 p.c. Ord. . .	91—91½*b*	+½	90½—90½
600,000	,,	Sept. 25	7	7	Do. 7 p.c. Red. Pref.	102—105*b*	..	..
165,736	,,	Aug. 28	8	9	Maidstone 5 p.c. Cap. . .	125—135	+7½	127½
63,480	,,	June 26	3	3	Do. 3 p.c. Deb. . .	55—60	+2	..
75,000	5	,,	5	7	Malta & Mediterranean .	3½—3⅝	..	..
541,920	Stk.	Nov. 20	4	4	Montevideo, Ltd. . . .	58—63*	..	60½—62
1,875,892	,,	July 24	5½	5	Newcastle & Gateshead Con.	83½—84½	..	..
250,166	,,	,,	4	4	Do. 4 p.c. Pref..	74—75*d*	..	..
529,705	,,	June 26	3½	3½	Do. 3½ p.c. Deb.	69—71*d*	..	..
15,000	10	Aug. 28	11	11	North Middlesex 10 p.c. .	16—17	..	..
75,940	10	,,	7 7/10	7 7/10	Do. 7 p.c. .	11½—11½	..	..
300,000	Stk.	May 8	9	7	Oriental, Ltd.	100—103	+1	101—102
138,120	,,	June 26	7½	7½	Plym'th & Ston'house 5 p.c.	112—117	..	..
60,000	50	Aug. 28	13	13	Portsea Island B . . .	99—102	..	..
100,000	50	,,	12	12	Do. C	95—100	..	..
2,289,909	1	—	—	—	Primitiva Ord.	8/0—9/0	..	8/3—8/10½
311,100	100	June 2	4	4	Do. 4 p.c. Red. Deb.. .	76—79	..	77
600,000	Stk.	July 24	4	4	Do. 4 p.c. Red. Deb. 1911	57—62	..	..
220,335	,,	June 26	4	4	Do. B. Aires 4 p.c. Rd. Db.	57—62	..	..
321,670	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	57—62	..	..
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref. . .	7½—7½	..	7 15/16—7 31/32
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	42—44	..	43½—44
270,000	Stk.	Aug. 28	5/8/4	5½	Sheffield A	103—105*e*	..	..
419,968	,,	,,	5/8/4	5½	Do. B	103—105*e*	..	..
1,047,000	,,	,,	5/8/4	5½	Do. C	103—105*e*	..	..
90,000	10	Oct. 23	8	6	South African	7—9	..	..
6,609,895	Stk.	Aug. 14	6½	5	South Met. Ord..	99½—101½	..	100—101
102,580	,,	July 10	5	5	Do. Red Pref.. .	98—100	..	..
1,895,445	,,	,,	3	3	Do. 3 p.c. Deb.. .	60—63	..	61½—62
734,000	,,	Sept. 11	6½	6½	Do. 6½ p.c. Red.Deb.	103—105	..	..
91,500	,,	Aug. 28	8½	8½	South Shields Con. . . .	134—135*d*	..	..
2,087,795	,,	Aug. 14	6½	6½	South Suburban Ord. 5 p.c.	105—110	+1	108½
368,837	,,	June 26	5	5	Do. 5 p.c. Deb.	95—100	+2	97½—98½
647,740	,,	Nov. 6	5	5	South'mpt'n Ord. 5 p.c. max.	83—86	..	..
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	73—78	..	..
250,000	,,	Aug. 28	7	7	Swansea 7 p.c. Red. Pref. .	102—104	..	102½—103½
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb..	104—106	..	..
120,000	,,	July 24	8	8	Tottenham District A 5 p.c.	118—121	..	..
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	100—103	..	103
181,255	,,	June 12	4	4	Do. 4 p.c. Deb.	76—80	..	..
258,251	,,	Aug. 28	7/14/4	5	Tynemouth Con. and New Uxbridge, Maidenhead, & Wycombe 5 p.c.. .	84—86*d*	..	..
187,294	,,	Aug. 28	6½	6½	Do. 5 p.c. pref. .	102—107	..	102
68,330	,,	Aug. 28	—	5	Do. 5 p.c. Maidenh'd	95—100	..	..
91,800	,,	—	—	—	Do. 5 p.c. Maidenh'd	100—105	..	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 10	9½	9½	Wandsworth A 5 p.c. .	140—145	..	..
235,636	,,	,,	7½	7½	Do. B 3½ p.c. .	120—125	..	..
108,073	,,	,,	6/7/9	6/9/6	Do. C	102—107	..	..
240,865	,,	,,	6/7/9	6/9/6	New Ordinary.	..	..	..
352,000	,,	,,	7½	7½	Wimbledon 5 p.c. . .	116—121	+1	..
98,000	,,	,,	7½	7½	Epsom 5 p.c.. . . .	122—127	..	..
30,426	,,	June 26	3	3	3 p.c. Deb.	55—60	..	59—60

Quotations at—*a*.—Bristol. *b*.—Liverpool. *c*.—Nottingham. *d*.—Newcastle. *e*.—Sheffield. * Ex. div.

The following transactions were recorded during the week:

On Monday, Aldershot "C" 82½, Commercial 3½ p.ct. 94½, European 8½, Gas Light and Coke 95⅛, 95⅜, 96½, 3½ p.ct. maximum 62½, 4 p.ct. preference 80, Hastings and St. Leonards 5 p.ct. converted 99½, Imperial Continental 173, 173½, 174½ *ex* div., Montevideo 60¼, *ex* div., Primitiva 8s. 3d., 8s. 10½d., San Paulo 5 p.ct. debentures 43⅜, South Metropolitan 100, 100¼, 101, South Suburban 5 p.ct. 108½, Tottenham "B" 103. Supplementary prices, Liverpool 5 p.ct. 90⅜.

On Tuesday, Brentford "A" 115, 116, "B" 116, 117, 4 p.ct. debenture 78, Continental Union 37, 37½, 7 p.ct. preference 92½, European 8½, Gas Light and Coke 95⅜, 96½, 3½ p.ct. maximum 62½, 62⅞, 63, 3 p.ct. debenture 61½, Imperial Continental 173, 174½, 175 *ex* div., Primitiva 8s. 4½d., 8s. 6d., San Paulo 5 p.ct. debentures 43 13/16, 44, South Metropolitan 100, 100¼, 100⅜, 101, 3 p.ct. debenture 62, South Suburban 5 p.ct. debenture 97½, 98½, Swansea 7 p.ct. preference 102¾, 103¼. Supplementary prices, Liverpool 5 p.ct. 90½.

On Wednesday, Brentford "A" 118, "B" 118, 4 p.ct. debenture 79, Gas Light and Coke 95½, 95⅝, 96¼, 3½ p.ct. maximum 63¼, 4 p.ct. preference 80, 80⅜, Imperial Continental 175, 176 *ex* div., Maidstone 5 p.ct. 127½, Montevideo 61½ *ex* div., Oriental 101, Primitiva 8s. 4½d., 8s. 6d., 8s. 7½d., 8s. 9d., San Paulo 6 p.ct. preference 7 13/32, 7 29/32, 5 p.ct. debentures 44, South Metropolitan 100, 100¼, 100⅞, 101, South Suburban 5 p.ct. debenture 98½, Uxbridge, Maidenhead, and Wycombe 5 p.ct. 102, Wandsworth 3 p.ct. debenture 59, 60.

On Thursday, Alliance and Dublin 4 p.ct. debenture 65¼, Brentford "A" 117, "B" 117½, 118½, 5 p.ct. preference 92, 93, Commercial 3½ p.ct. 94⅜, European 8⅜, Gas Light and Coke 95¼, 95½, 96, 96¼, 3½ p.ct. maximum 62⅜, 4 p.ct. preference 80, Imperial Continental 176 *ex* div., Montevideo 61½, 62 *ex* div., Oriental 102, Primitiva 8s. 8¼d., South Metropolitan 100⅜. Supplementary prices, Barnet District 4 p.ct. cons. debenture 76, British, Norwich, 3 p.ct. mt. debentures 54, 54½, Folkestone 78, Oxford 5 p.ct. debenture 99, Uxbridge, Maidenhead, and Wycombe 4 p.ct. debenture 77.

On Friday, Aldershot "C" 81½, 4 p.ct. preference 73½, 74½, Bournemouth 5 p.ct. 12⅜, "B" 12⅝, 6 p.ct. preference 11 3/16, 11 7/16, Brentford "A" 118, "B" 118, British 116¾, Gas Light and Coke 95¼, 95⅜, 95½, 96, 3½ p.ct. maximum 63½, 4 p.ct. preference 80 1/16, 3 p.ct. debenture 61½, 62 3/16, Imperial Continental 175, 176 *ex* div., Primitiva 8s. 9d., 4 p.ct. debenture 77, South Metropolitan 100¼, 100⅜, 3 p.ct. debenture 61¼.

There were ample supplies of loanable credits in the Money Market at the end of the week. The highest rate recorded was 3 p.ct., and at the close balances were offered at 2 p.ct. Discount rates were weak, but steadied on the result of the Treasury Bill allotment becoming known, the average rate—£3 12s. 10·79d. p.ct.—being a drop of 10·59d. on the previous week.

There was very little change noticeable in the Foreign Exchange Market. On the week the French franc rose slightly, and closed at 86.20. The Belgian franc also improved in sympathy, and closed at 94.75. Italian lire were practically unchanged at 106.55. Sterling on New York closed at 4.63⅜, or 1/16 lower than a week ago.

India was a buyer in the Silver Market, and the cash price rose to 33 5/16d. per oz. Gold was quoted at 89s. 11d. per oz. *ex* London.

The Bank rate is 4 p.ct., to which it was raised from 3 p.ct. on July 5, 1923. The deposit rates of the discount houses are 2 p.ct. at call and 2¼ p.ct. at notice. Bankers' deposit rates are 2 p.ct.

New Plant at Windermere.—The Windermere District Gas and Water Company have placed an order with the Whessoe Foundry and Engineering Company, Ltd., of Darlington, for the supply and erection of one Livesey washer and one cast-iron tower scrubber capable of dealing with a make of 20,000 c.ft. of gas per 24 hours.

Uxbridge, Maidenhead, Wycombe, and District Capital Issue.—The tenders for the £60,000 of new capital which Messrs. A. & W. Richards offered on behalf of the Directors of the Uxbridge, Maidenhead, Wycombe, and District Gas Company were opened on Thursday last. The issue was considerably over-subscribed, the tenders amounting to over £110,000. Those for the 4 p.ct. perpetual debenture stock ranged from £80 down to the minimum of £76; the average being £77 11s. 5d. p.ct. For the 5 p.ct. preference stock, from £99 down to the minimum of £92; the average being £94 12s. 1d. p.ct. For the new ordinary stock, from £110 down to the minimum of £105; the average being £107 17s. 10d. p.ct.

Gas Supply in Lanark Middle Ward.—At a meeting of the District Committtee of the Middle Ward of Lanarkshire—Mr. W. Templeton presiding—a minute of the Gas Supply Committee was submitted showing that negotiations had now been completed with the Town Council of Motherwell and Wishaw for a supply of gas to the Overtown and Waterloo area, and the terms and conditions upon which the Town Council would agree to extend their gas mains were explained. The Committee considered the question, and were of opinion that the Burghs Gas Supply Act as amended should be adopted within the Overtown and Waterloo Special Lighting District. Mr. David Thomson called attention to the question of gas supply in the Shotts district, and inquired whether steps were now proposed with a view to the extension of the Middle Ward gas supply scheme to this area. A Sub Committee was appointed to consider and report on the whole matter.

Conservation of Coal.—Addressing the Accrington Discussion Class, on "The Conservation of Coal," Mr. A. J. Harrison (the General Manager of the Accrington District Gas Board) said the country owed its position as the premier industrial nation to the rapid development of its coal resources. Coal was cheap, but to a great extent wasted. Nations later in development had discovered fuel deposits of their own, and were not only developing them on better lines, but by study and close research were obtaining marked supremacy in the use of fuel. Conservation of the coal remaining to this country, and increased efficiency in power production, were imperative. Mr. Harrison emphasized that this was being increasingly found in the utilization of gas. For many years the low costs of labour and apparently high cost of gas had prevented manufacturers from considering its use, but it had been realized that the actual cost of the fuel was not the prime consideration. Gas was easily transported, any temperature could be obtained by it and maintained without trouble, and heat could be applied just as required to any definite part of a process.

High-Pressure Lamps for Middlesbrough.—The Middlesbrough Corporation are to improve the lighting of North Ormesby Road by fixing twelve high-pressure gas lamps, each of 1000 c.p., on pillars 12 ft. high, and spaced about 48 yds. apart. The estimated cost of installation is about £184, and the charge for maintenance, including gas, mantles, glassware, and labour, will be £107 a year, equal to about 2·1d. per candle per annum. At present the road is lighted by thirteen low pressure lamps costing £59 a year for gas, mantles, &c. These lamps give a total illuminating power of 2300 candles, and the cost per candle per annum is about 6·2d.

"The Smoke Nuisance."—At a luncheon of the Hull Rotary Club last Friday Mr. Harold E. Copp, M.Inst.C.E., Manager and Engineer of the Hull Branch of the British Gas Light Company, gave an address on this subject. Much of the smoke from factory chimneys, he said, could be avoided by the judicious blending of fuels; and, provided that modern methods of mechanical firing were introduced, fuel economy could be effected. Mr. Copp charged the domestic chimneys of the cities as being the worst offenders. The gas industry had been by far the greatest agency for the prevention of smoke. This fact had been recognized in America, where the industry was making greater progress than in this country, despite the higher relative costs ruling there.

The electric light failed suddenly at Cleckheaton last week, during the busy part of the early evening. Gas users carried on merrily, and the brilliance of the lighting at the Spenborough Gas Committee's showrooms in Albion Street formed a strikingly demonstrative advertisement of the value of this illuminant.

The Halifax Corporation Gas Department have one of the brightest stands at a trade revival exhibition organized by Halifax traders, and opened at the Drill Hall, on Nov. 26, by the Mayor (Alderman J. H. Waddington, who for many years past has been Chairman of the Gas Committee). The Mayor was supported by the Mayoress and the President and officers of the Halifax Chamber of Trade. The exhibition includes almost every trade, and on the gas and several other stands there are daily demonstrations in the application of household appliances.

The wholesale and retail traders of Birmingham are, as last year, giving their assistance, through the various business organizations, on behalf of the Lord Mayor's Fund (recently inaugurated) for relief of distress due to unemployment. A Sub-Committee is working on the outline of a scheme for a skill competition for which it is proposed to issue 1s. tickets to be sold to the public. The competition will consist of estimating the output of gas from the works of the Birmingham Corporation Gas Department on a certain day in February, 1925. Valuable prizes, including a motor car, are offered.

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By order,
JAS. C. WADDINGTON,
Clerk.

Council Offices,
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